JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH

January Meeting, 1901

SUBJECTS: Glanders — Diphtheria Bacilli in Well Persons — Drainage, Reclamation, and Sanitary Improvements of Marsh Lands near Boston (Illustrated).

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JOURNAL OF THE

Massachusetts Association of Boards of Health.

ORGANIZED 1890.

[The Association as a body is not responsible for statements or opinions of any of its members.]

Vol. XI. | April, 1901. | No. 1.

JANUARY MEETING

OF THE

Massachusetts Association of Boards of Health.

The January quarterly (or regular annual) meeting of the Massachusetts Associations of Boards of Health was held in Boston at the Parker House on the afternoon of Thursday, January 24, Dr. Samuel H. Durgin, Vice-President, in the chair.

The Chairman.— The time has arrived, gentlemen, when we should commence our business of the afternoon. The first thing on the programme is the election of officers for the ensuing year. A motion for a nominating committee would be in order.

Dr. Prescott.— I move a nominating committee of three be appointed by the chair.

Dr. Miller.— I second the motion.

The motion was adopted.

The Chairman.— I will appoint Dr. Pilsbury, Dr. Chase, and Dr. Everett. If they will assemble in another part of the room and attend to this duty as soon as possible, we will get at the remainder of the business readily. During this time I will request members of the Ex-

ecutive Committee to assemble at this end of the room for a short session. All those who have names to hand in for membership in the society will please hand them in now at this end of the room. You will now listen to the report of the last meeting by the Secretary.

The minutes of the meeting held at Fitchburg on Oct. 18, 1900, were read and approved.

THE CHAIRMAN.— The Secretary will please read the vote of the Executive Committee.

MR. COFFEY.— The Executive Committee by vote recommend the following persons for membership: —

WILLIAM RODMAN PEABODY	Cambridge.	
G. LINCOLN ALLEN	Salem.	
MORGAN MCSWEENEY	Salem.	
DR. A. R. PERRY	Somerville.	
DR. A. L. BROWN	Springfield.	
J. C. RAUSEHOUSEN	Springfield.	
W. H. HITCHINGS	Somerville,	Veterinary Surgeons.
LANGDON FROTHINGHAM	Boston,	

THE CHAIRMAN.— What is the pleasure of the Association in this matter?

On motion of Dr. Prescott the Secretary was instructed to cast one ballot for these gentlemen. The Secretary cast the ballot, and they were admitted to membership in the Association.

THE CHAIRMAN.— Is the Nominating Committee ready to report? If not, we will listen to the annual report of the Treasurer, Dr. Field.

Dr. Field then read his annual report as Treasurer, as follows: —

TREASURER'S REPORT FOR 1900.

RECEIPTS.

Balance on hand	$919.50	
Received from interest	28.12	
Received from annual assessments	300.50	
Total receipts		$1,248.12

Expenditures.

Prize essay	$50.00	
Printing	44.30	
Postage and revenue stamps	33.62	
Cigars, dinners for guests, etc.	31.50	
Clerical assistance	22.00	
Total expenditures		$181.42
Balance to 1901		1,066.70
		$1,248.12

Of this balance $967.28 is in a saving's bank, drawing interest.

Respectfully submitted,

James B. Field, *Treasurer*.

Examined and approved as correctly cast and properly vouched for.

J. Arthur Gage, *Auditor*.

On motion of Dr. Prescott the report was accepted and placed on file.

The Chairman.— It might seem that the length of time allotted for a discussion upon the subject uncompleted at the last meeting was rather small, but it became necessary in order to get through with the programme this afternoon. We will have a discussion for twenty minutes upon this subject, and this will necessitate giving each speaker but five minutes. The first will be that of Dr. Palmer, who has a new case to report.

Dr. Palmer.— Mr. President and gentlemen, I don't know whether I shall be able to report my case intelligibly in the five minutes that the President has allotted me; but he can call me down at any time he chooses.

Your President has honored me by asking me to report a case of glanders that came into the Framingham Hospital during the month of November. On the 12th of November, late in the evening, I was first called to see the case. Before I give any description of the case as I found it, I will read a letter from the physician who had it in charge before the patient came into the Framingham Hospital, and who, by the way, was the chairman of the Board of Health in the town that he came from, and he gives me the following history of the case: —

MILFORD, MASS., Jan. 15, 1901.

Dear Doctor, — Sunday, Oct. 21, 1900, in the afternoon I was called to Adams's livery stable to attend one of the hostlers, who was confined to his room in a barn. I found Edward Mahoney, aged about twenty-seven. Patient said he had been feeling poorly for a day or so. The attack was ushered in by chills, or rather chilliness, flashes of heat, lassitude, headache, pains in back and limbs, feeling of some constriction about the chest. Patient complained most of feeling of soreness about body and limbs and as though he "had been pounded," also complained of headache and fever. Pulse about 100. Temperature, 102 degrees.

Diagnosis: grip.

October 29. Saw patient downstairs in barn in morning (was in the offi e) and said he was feeling much better. Did not examine him again, as fever had apparently left him and he was free from pain, but was feeling some lassitude.

Patient left stable in morning after I saw him, and *am informed* that for the remainder of the day (Monday, 29) and all the next day following, Tuesday, 30, he was intoxicated. This was not an unusual condition for the patient to be in, whether sick or well.

October 31. Patient came into my office early in the morning, looking very "rocky." Said he had been exposed to the cold and wet, and thought he "must have taken a fresh cold." He complained of a severe, sharp, and lancinating pain in the left side of chest. Patient looked pale and anxious. Pulse about 100, and temperature 101 3-4 degrees. Difficult respiration. There was dulness over the apex of the left lung. There was constant dry cough. My diagnosis is acute pleurisy.

From November 1 to November 6 there was no change in the symptoms, except that the dulness increased, and the pain increased also. Temperature, 102 degrees.

November 7. Dr. George T. Curley called in to-day in consultation, and diagnosed pleurisy. He was of the opinion that there was some fluid in the lung, and advised aspiration to be done the next day. This I did not do, but put patient on large doses of Syr. Ferri Iodidi.

November 8. Condition of patient unchanged, pulse and temperature remaining about the same all through the attack. Patient delirious at times.

November 9 to 11. Symptoms unchanged. Delirium almost constantly.

November 12. Delirium severe. Pulse weaker, but temperature approximately the same. Dr. Curley again in consultation, and thought it would be advisable to aspirate, which we did, but found no fluid.

To-day, for the first time, was noticed a pustular eruption about the hands and arms and one or two about the body. These pustules varied in size from a ten-cent piece to a quarter of a dollar. The throat was clear, and there was no glandular enlargement in any place about the body.

Patient later in day was removed to Framingham Hospital.

Yours respectfully,

CHARLES H. COLE, M.D.

That is the history of the patient up to the time he entered our hospital. I saw the patient late at night, and found him in a wildly delirious condition, a pulse of 120, temperature of 103 to 104 degrees, respiration of 50, in a typhoidal condition, constantly talking, muttering, picking at the clothing and into the air, and having a dry, brown furred tongue. I looked into the throat that night, and it was fortunate that I did; and the only thing to be seen was a large sore on the base of the tongue on the right side, which looked very similar to a chancre. I would say that this sore had not been recognized by the other doctors, neither was any other doctor who saw the case with me afterwards able to see it, because it was impossible to see into his mouth. There was no running from the nose, there was practically no glandular enlargement; but there was a very suspicious eruption, which was referred to by Dr. Cole. The eruption was so suspicious, pustular, and some of it umbilicated, that I did not like the looks of the patient; and I ordered him strictly quarantined, and left word for our senior physician in town, a man of great experience and one who had seen much of small-pox, to be called in consultation the next morning.

At my visit the next morning about 9 I found that this experienced physician, who had seen very many cases, had been present, and had diagnosed the case as unmistakably a case of small-pox, and immediately had rushed away to the village to get vaccine points to vaccinate all the possibly infected cases.

I want to diverge enough to say, gentlemen of the boards of health of the State, that you can imagine what my feelings were. I had lain awake at night dreaming of the time when I might have a case of small-pox to contend with, and wondering what in creation I should do with one if I had it; and my dreams had become a reality. I not only had, according to this physician, a case of small-pox, but I had it very warmly and comfortably located in a general hospital. I leave it to you individually, gentlemen, to imagine how I felt. Suffice it to say that I did not enjoy my mind.

This good doctor was quite exercised in his mind, because I questioned his diagnosis. I did not doubt his word, but I thought I would have further advice. So I sent to that epitome of all sanitary knowledge in Massachusetts, that has a good reputation everywhere,

not only in this State, but in other States,— the State Board of Health. One of their representatives came out and saw the case; and in a very judicious and politic way he said: "It is a very suspicious case. It may be small-pox. At any rate, I would advise you to isolate the case, and regard it as such."

I am not noted for my conservatism; but I have since congratulated myself that the best thing I did in that case was to be on the safe side, and throw out as many anchors to windward as I possibly could. Without delay I summoned home from Boston, Dr. Sharp of our local board, and we telephoned in for the wisdom that there was in the Boston City Board of Health; and one of their doctors came, Dr. T. B. Shea, bearing the first message of peace, and the olive branch. After looking the patient over carefully, he said, "I am sorry to disagree with my beloved friends of the State Board, but I think you may be assured that you have *not* a case of small-pox." That "not" was the happiest word that I ever heard in my life.

The history of that case during the day was this: The symptoms all rapidly increased. The patient's condition grew rapidly worse. The pustular eruption spread over the body, so that there probably were 100 pustules before the time of his death. The pustules were both discrete and confluent. They were umbilicated. They had the red flush around them. They did not appear in the mouth; they were not in the nose. Besides the pustular eruption, which was so similar to that of small-pox, was the inflammatory condition of the joints,— the finger joints, both wrist joints, both elbow joints, the right knee and the right ankle, and the toes of both feet looking very suspicious that pus might be present. He lived about thirty-six hours, and died on Wednesday morning early, his temperature rising to 108 degrees before he died.

We had a *post-mortem* examination made, through the kindness of Dr. Richardson of the Massachusetts General Hospital Pathological Department; and the gross pathology of the case was briefly this: The heart, the stomach, the bowels, the bladder, the testicles, and the liver were normal, also the blood-vessels. Both kidneys were very large. The spleen was about two and a half times its normal size and soft. There was a slight pleuritic condition of the left lower lobe, where the pain had been located, and where it was thought

that there was fluid, but no fluid was present. The left lung was in a condition of septic pneumonia. The meninges of the brain were ædematous. There were no lymphatic glands infected. The nose was clear. Pus from these pustules was taken by Dr. Shea before death and a guinea pig inoculated, which after about forty-eight hours showed the typical testicular enlargement. Cultures were made, and the case was proved to be unmistakably a case of glanders.

The interesting features of the case were the absence entirely of any discharge from the nose or throat, the pustular eruption, which was so similar to that of small-pox, the short time in which the inflammatory action went on before the patient's death, there being no pus in any of these inflammatory joints, as there undoubtedly would have been, had his strength been sufficiently maintained to keep him alive a few days longer.

The source of infection was from a glandular horse in a stable in the town of Milford, which had been sick, killed, and buried without its being known what the disease was. Through the persistence of Dr. Rogers, agent of the Cattle Commission, the horse was exhumed; and a *post-mortem* showed it to have been unmistakably a case of glanders.

No harm came from its being in our hospital. The hospital was thoroughly fumigated, the nurses were quarantined, clothing was destroyed; and we have had no farther trouble, thanks be to the good Lord.

The Chairman.— The case was so full of interest that I have taken the liberty to let the gentleman pass beyond the time limit. Is there any gentleman from Fitchburg who would like to speak upon this question? If not, I will call upon Dr. Shea for a few remarks.

Dr. Shea.— Mr. Chairman and gentlemen, in regard to this particular case there is not much to be said. Dr. Palmer has covered the ground pretty thoroughly. We ought to learn something from these cases. I think in this case and all cases, you might say, of acute infectious diseases, where the occupation of the patient is dealing with horses, the question of glanders should always be considered. True glanders in the human being is very rare; yet cases occur occasionally, and we should be prepared to deal with them.

The eruption, as Dr. Palmer has described it, was very suspicious of small-pox, but the patient's occupation, and the history of the disease, suggested the existence of glanders.

Bacteriology is of great assistance in these cases, and from the work of the bacteriological laboratory the diagnosis of glanders was confirmed.

The Chairman.— Is Dr. Burr present? If so, would he like to say a word upon this case?

Dr. Burr.— I don't know that I can add much, Mr. President, except to emphasize the fact that it is not uncommon to find these cases of glanders in stables treated by men, hostlers, etc., in a very careless manner. One often goes into a stable and finds a man dressing a horse with sores upon the legs or other parts of the body or a discharge from the nose, and handling the parts without any care whatever. It is seldom that a man in that employ has not got some sort of a scratch or cut upon his hands. Certainly, glanders must be of very low virulence to man, or else we should have a great many more cases of human glanders. A case occurred about a week or two ago where a swab preparation from the nose of a suspected horse had been sent, by the attending veterinarian, to the laboratory for diagnosis. Guinea pigs were inoculated, and in the course of three days a positive diagnosis was made on the case. I had not seen the case in the mean time; but, when a positive result was obtained, I examined the case, and found it to be in a milk stable. The owner desired more time to treat the horse, and was very much surprised to think that immediate action should be taken; but, for fear of contaminating the milk supply, I decided that no time should be lost, and that the horse should be immediately killed. This same horse was driven and cared for by the hostlers who also handled the milk supply received at that milk stable. This case certainly illustrates the exceedingly careless manner in which cases of glanders in horses are treated by owners and attendants.

The Chairman.— The next item on the programme is a report of the committee on "Diphtheria Bacilli in Well Persons," by Dr. C. V. Chapin, chairman.

Dr. Chapin, Providence.— Mr. President, our committee regrets exceedingly to come before you again without being able to present a final report; but we have done a great amount of work, or, at least, the secretary of the committee has done a great amount of work, in sending out inquiries to those who are interested in this subject. All that we felt that we could do to-day was to present a brief summary of the replies received, in order that you might see how much trouble others are undergoing as well as ourselves, and to ask for an extension of time in order that we may await the results of investigations into this subject,— investigations into the relative presence of diphtheria bacilli in the well under different conditions. Such investigations are now being made by a number of bacteriologists, and the committee hopes later to receive returns from them; and from the information so obtained we hope to be able to deduce some reasonable plan of action which should be taken by boards of health in these cases. I will therefore ask Dr. Hill, the secretary of the committee, to state the position of the committee at the present time and what little we have learned.

Dr. Hill then presented the following report: —

REPORT OF COMMITTEE ON DIPHTHERIA BACILLI IN WELL PERSONS.

A meeting of this committee was held Nov. 15, 1900, at the rooms of the State Board of Health of Massachusetts, courteously offered for its use by Dr. S. W. Abbott.

Members present: Dr. Charles V. Chapin in the chair, Drs. Abbott, Denny, Gage, Shea, and Hill (secretary).

Members absent: Drs. Baker, Darling, Hudson, and Mr. Gove.

The chairman made an address, which was incorporated in the report read at the annual meeting, Jan. 24, 1901. (See below.) The answers to the circular of questions sent out by the committee to the various State and municipal boards of the United States and Canada were read and discussed. (See below).

The secretary was instructed to invite the co-operation of about twelve laboratories in different parts of the country, with the object

of determining by a large co-operative investigation the percentage of well persons not exposed to diphtheria who, nevertheless, have diphtheria bacilli present in the throat or nose, and the evidence of any diphtheria bacilli thus found.

It was voted to present a report of progress, and to ask for an extension of time for the committee at the next regular meeting of the Association.

ADDRESS OF THE CHAIRMAN OF THE COMMITTEE ON DIPHTHERIA BACILLI IN WELL PERSONS.

This committee believes that the problem intrusted to it cannot be settled off hand. There appear to be a number of preliminary questions which must be answered before we can decide what to do with well persons who are infected with diphtheria bacilli. We have assumed, however, that it is proved that the bacillus is the essential cause of the disease, and that it can be recognized with a reasonable degree of accuracy by the methods ordinarily employed in the laboratory.

Among the things which it seems important to know are: —

First. The prevalence of the bacillus among the well. If it is a fact that diphtheria bacilli are rarely found except in convalescents and those who are about the sick, it may be feasible to secure the isolation of such persons. But, if the organisms are pretty widely distributed, it will be a much more difficult matter. If it should turn out that there are three thousand or four thousand persons infected in Boston, would not the score or two that the Board of Health might discover object to isolation, and would not they receive the backing of the medical profession and the courts?

Second. Our problem might be simplified if we knew more about the degree of danger to be apprehended from the bacilli in the well. That they are sometimes dangerous is shown by some of the answers received from our correspondents. Moreover, it has long been known that well persons do transmit diphtheria to others. We have, on the other hand, found it to be probable that diphtheria bacilli in well persons sometimes lose their virulence. This suggests our next problem.

Third. How can we determine the virulence of the bacilli for human beings? The ordinary method of testing virulence is by the inoculation of guinea pigs, but some doubt has been thrown upon its reliability. Furthermore, it would hardly be feasible to test in this way any considerable proportion of cultures that daily come to our laboratories. Diphtheria bacilli are known to present great morphological differences, and it is possible that these differences may give some indications of the degree of virulence. But at present sufficient data have not been obtained to determine this point.

Fourth. What amount of evidence is required to determine the presence or absence of diphtheria bacilli in the well? Is a single culture from the throat sufficient? Experience has shown that there is a considerable margin of error in this. A negative culture may be followed by a positive culture. What the percentage of error is, is not known. It may perhaps be very considerable. As will be shown in the summary of the replies to our circular of questions, there is evidence to show that diphtheria bacilli are found in the nose more often than in the throat. In order to decide whether a person is infected with diptheria bacilli, shall we examine the throat or the nose, or both, and shall we trust to one swabbing or shall we require two or three? Should not both nostrils be examined?

Fifth. Is there any difference in the conditions under which diphtheria bacilli are found in well persons, on which can be based different methods of control? It may be that those who have been recently infected are the most dangerous. Perhaps infected well persons, who have not been in recent contract with the sick, rarely do harm, and need not be isolated; while those who are with the sick, and show the bacilli, should be. We do not know about this at present; but we should know before we formulate any plan of official discrimination.

Sixth. Convalescents from diphtheria usually retain bacilli until after they have entirely recovered. They then belong to the class of infected well persons. If they are isolated, why should not all infected well persons be isolated and *vice versa?*

It was to obtain data for the solution of the problems here suggested that the committee sent out circulars of inquiry. The following summary of these replies is here submitted: —

SUMMARY OF REPLIES TO QUESTIONS OF COMMITTEE ON "DIPHTHERIA BACILLI IN WELL PERSONS."

1. Have you established an organized system for the bacteriological examination of cases of suspected diphtheria?

Cities with laboratories	37
States with laboratories	4
Provinces with laboratories	2
Towns depending on State laboratories	7
Hospitals	2
	52
Cities without laboratories	10
States without laboratories	2
Total replies by circular	63
Replies by letter	11
Total replies	74

2. What number of cases examined for diagnosis show a negative culture on the first examination and a positive culture on a subsequent examination? (Give exact figures, if possible.)

None	1	
Very few	8	
½ to 2%	7	
3 to 5%	8	
6 to 10%	2	
12½% (hospital)	1	
25%	1	(2% if swabs exam.)

3. What do you require for the release from isolation of diphtheria patients?

1 neg. culture, nose or throat	18	
1 " " nose and throat	2	
1 " " or time limit after memb.	4	
1 " " and time limit	3	
2 cons. neg. culture, nose or throat	5	(2 hospital)
2 " " " nose and throat (Boston)	1	
2 " " " " " " (hospital)	1	
Absence of bacilli	2	

Baltimore and Providence require also one neg. culture from others in family.

No cultures required:

		Laboratory.	*No Laboratory.*
Physician's certificate alone		5	6
" "	and time	5	6
" "	or time	0	1

In three of these, cultures are advised also.

4. Do you examine bacteriologically, as a routine practice, the throats and noses, or both, of those who may be in contact with cases of diphtheria?

Yes, 6; sometimes, 8; in inst., 6; no, 20.

5. When cultures from diagnosis are taken separately from both nose and throat of sick persons, what proportion of the cases so treated give the following results? (Give actual figures.)

Rochester . . . . 75% of cases show th. + n. +
Fitchburg . . . . 2 of cases show th. + n. +
Providence and Newton, Hospital . . . . . . 196 cases { th. + n. +, 32%; th. + n. —, 13%; th. — n. +, 26%
total, 71%

Providence: of 15 cases where both nostrils were examined, 7 were positive in both nostrils; 8 were positive in one nostril only.

6. When cultures are taken separately from both nose and throat of well persons exposed to diphtheria, what proportion of the cases so tested show both throat and nose positive, both negative, or one positive, the other negative?

	Th. + N. +	*Th. + N. —*	*Th. — N. +*	*Th. — N. — Total.*
Providence . .	32	35	98	621 = 286, or 20% pos.
Syracuse . . .	0	61	5	59 = 125 (asylum)
Newton Hospital,	4	1	2	1 = 8
Willard State Hosp.,	0	1	18	902 = 921 (all in hosp. considered exposed).

Syracuse: 3 of the pos. developed clin. symptoms and died. The rest were immunized and remained well.

	Th. + N. +	*Th. + N. —*
Fitchburg . . .	20	5 pos.
Boston	20	4 (99)
Boston	35	1 (98)
Minneapolis . .	200	5 (1 had had diph., another developed it later).

Rochester. A small number.
Minnesota. *See* tables.

Throat only, 4; total, 275; 15 pos. or 5.5%; .8 developed disease th. and n. = 4; total, 1,840.

th. + n. +, 2%.
th. + n. —, 5.4%
th. — n. +, 7%

total, 14.4% 16% developed diphtheria.

7. When cultures are taken separately from both nose and throat of **well** persons **not** exposed to diphtheria so far as known, what proportion of the cases thus tested show the following results?

	Th. + N. +	*Th. + N. —*	*Th. — N. +*	*Th. — N. —*	*Total.*
Providence:					
Hospital	6	2	12	10	30
Pulm. clin. . . .	0	1	3	6	10
School free of diphtheria 3½ years .	10	13	16	121	160
Children admitted to asylum . . .	2	0	0	2	4
	18	16	31	139	204 or 30% pos.

Syracuse . . . . 300 examined: all neg.
Newton Hospital . . 5 " " "

Note.—Providence: exposed persons, 20% +; not exposed, 30%.

		Throat Only.	
Providence:	School	223	7 pos.
	Diphtheria officials	20	0 "
	Throat and nose clin.	162	3 "
	Providence Hos. patients	3	0 "
	Orphanage (no diphtheria 18 months)	50	1 "
		Nose only.	
	Providence poor patients	15	0 pos.

Throat only, Providence, total, 473; th. + 2.3%; th. and n. = 3; total, 509.

th. + n. +, 3.6%
th. + n. —, 3.2%
th. — n. +, 6.2%

total, 13. %

8. What proportion of those exposed take the disease in your experience? (Give actual figures.)

2% = 1 (if irritants are avoided)

20 to 30 = 4

9. What proportion of those exposed, who show also the diphtheria bacilli in their throats or noses, subsequently and within a short time develop the disease? (Give actual figures.)

Such cases observed equals 3; 5%, 1; 50%, 1; 80%, 1.

10. Do you make any difference in your management of the classes of cases mentioned below? Which do you officially designate as diphtheria and which do you placard and isolate?

a.	Plac. and is., 44.				
b.	40.	Is. and wait, 1.	Is. if abundant, 1.		
c.	39.	Is. and wait, 1.		1.	No plac., 1.
d.	36.	Is. and wait, 2.		1.	Plac., 1; another cult., 1.
e.	35.	Is. and wait, 2.		1.	Plac., 1; no plac., 1; is., 1.
f.	17.				
g.	17.				
h.	1.				
i.	0.				

11. Do you test the virulence of diphtheria bacilli in doubtful cases for diagnosis?

Yes	6
Sometimes	3
On request	2
Rarely	2
When symp. and exp. both abs.	1

12. Do you test the virulence of diphtheria bacilli persisting in the throat of a recovered diphtheria patient? In what proportion of cases is this done? (Please give actual figures.)

Scientific interest only	1	
On request	8	Very few cases.
Sometimes	7	

15. Do you find any relation between the type of diphtheria bacilli found and their virulence?

Short, regular, deep-stained forms in cases without much sickness; 1 ditto found non-virulent in 17 cases, 1; aberrant forms virulent frequently; all forms

virulent sometimes; non-virulent sometimes, 1; long bacilli with irregular spots most virulent, 1.

17. Have you any evidence that the bacilli gradually lose virulence during the recovery of a case of diphtheria?

No: virulence persists if originally present, 1. No, 1. Yes, 3. Sometimes, 3. Clinical evidence, 3; some evidence.

18.

Terminate isolation, if non-virulent	8
Isolate until bacilli disappear	4

19. Give particulars of cases in your own experience where well persons having diphtheria bacilli in their throats or noses have communicated the disease to others. (Please state whether these well persons were convalescents or had not had diphtheria themselves.)

Waltham.—Several mild nasal cases, not ill, produced disease in others.

Seattle.— Believe cases are infective for some weeks (cases released ten days after membrane).

Buffalo.— Many instances. Example: child not ill, except for very slight sore throat, visited in Buffalo. Seven weeks after a severe case in family visited developed. Virulent KL in throat of visitor.

Providence.— Child with diphtheria and KL May 18 speedily recovered. KL persisted till June 20. June 11 another child (diphtheria and KL) died June 17. See Am. Rep., 1897, p. 19; 1898, p. 23.*

St. Louis.— Two epidemics due to introduction of children well but carrying KL. In one case, child came from unsanitary district, but no exposure to KL proved. This child yielded virulent KL. See *Virginia Medical Journal*, 97.

Boston.— One convalescent boy well, but carrying virulent KL, left Boston for Brockton to escape isolation. Within four days three clinical cases with KL developed in house visited.

Brookline.— Epidemic due to milk infected by healthy milker carrying KL in throat. *Journal Massachusetts Association Boards of Health*, April, 1900.

Fitchburg.— KL in throat of man delivering milk, perhaps infected from fatal case seven months previous.

Baltimore.— Two sisters, one positive, one negative, both well: negative sister developed diphtheria and KL, positive sister remained well.

Ontario.— Five men drivers were exposed to a man who had been visiting his home where diphtheria was. Five families miles apart were infected.

* Cases showing probable infection from well persons.

New York.— Child had tonsillar diphtheria. Discharged June 15. Admitted to another hospital July 2. August 17 a case of diphtheria developed in a ward not connected with the one this child was in. Clinical examination of all inmates showed nasal discharge and KL virulent in this child.

Quebec.— Well-marked cases from persons well or with slight catarrhal anginas.

Burlington.— Several cases contracted from convalescents from Brooklyn, N.Y.

Willard State Hospital.— Infection apparently carried to a distance by husband whose wife had bacilli in throat, but was well.

Letters received by Dr. Chapin referring to subject of Question 19:

Chicago, 1897.— Four cases fatal diphtheria (2 KL) in nursing infants from well mothers carrying KL in throats. Mild anginas with KL in adults a prolific means of spread. In June a single case in a school might go no further: in September 20 cases might follow.

Germantown, Pa.—Case of membranous croup and KL recovered, bathed and given new clothing, and discharged after one neg. from throat, entered Lutheran Orphan Asylum. Four days later an epidemic with KL began, involving 33 cases and one death. First victim played with recovered case immediately on return.

Ohio, San. Bulletin.— Quotes Holstrom, of Stockholm: Domestic taken ill with diphtheria traced to bacilli in throat of soldier (perfectly well) from regiment in which diphtheria existed.

Also 151 men of this regiment (786 men) showed KL, and were isolated. A daughter of one of these isolated men developed diphtheria. His wife was found to have bacilli in throat. On inquiring, it was found that this man had broken quarantine, and visited his home twice.

Minnesota.— Two always well children carrying bacilli sent to homes. Diphtheria broke out shortly after their arrival. No other source of infection discovered. One always well girl carrying KL went to her home. Step-mother and two children developed diphtheria and KL within a few days. This family was practically isolated in the country.

Minneapolis.— One case (account obscure).

20. If diphtheria breaks out in an institution (asylum, jail, school, reformatory, hospital, etc.), what is your procedure to control and get rid of the epidemic?

(*a*) Do you take cultures from all inmates present at the time of the outbreak or only from those exposed?

(*b*) Do you take cultures from all persons admitted to the institution during the course of the epidemic?

(*c*) Do you isolate all those showing positive cultures in the absence of lesions or only those with suspicious throats?

(Please state in *a*, *b*, and *c* if cultures are taken from throat only, or from both throat and nose.)

(*f*) How do you determine when it is safe to allow those exposed or infected to mingle with the uninfected inmates again?

(*g*) What precautions, other than bacteriological examinations of nose and throat and isolation of those showing positive cultures, do you consider necessary?

	A.	*B.*	*C.*	*F.*	*G.*
Baltimore	All.	Yes.	All pos.	1 neg. th.	Immunize sometimes.
Buffalo	All.	No.	All pos.	KL absent.	Notify milk dealers, sch., churches, public inst.
St. Louis	All.	Is. newcomers 2 weeks and imm., then taking cult.	All pos.	KL absent.	Imm. newcomers.
Providence	All th.	Yes, n. & th.	Yes, n. & th.	KL absent.	
Colorado	All.	Yes.	Th., yes.	KL absent, & 2 weeks.	
San Francisco	All.	No.	All pos. & susp.	KL absent, or one mo. if non-vir.	Immunize.
W. Newton Hosp.	All n. & th.	Yes.	All pos. & th.	2 neg. cult. 24 h. apart.	
Brockton	All exposed.		All pos. th.	Wait till incub. is over.	
Washington	All exposed.	No.	All pos. th.	KL absent.	
Fort Wayne	All exposed.	No.	All pos. th.	KL absent.	
Rochester	All exposed.	No.	All pos.	KL absent.	Gargles, sprays, attend to teeth; sun and out of doors.
Syracuse	All exposed or susp.	Yes.	All pos. th. *or* n.	Cults. 5 days aft. mem. gone.	Immunize.
Massachusetts	All exposed.		All pos.	Neg. cult	
Brookline	Advise all.	Advise.			
Cambridge	Advise all.	Advise.	All pos.	Adv. 2 cons. negatives n. and th.	

	A.	*B.*	*C.*	*F.*	*G.*
Boston	Advise all.	Advise.	All pos. n. & th.	2 cons. prs. synchronous neg. cult. n. and th.	
Philadelphia . . .	Advise all.	Advise not done.	All pos. th.	KL absent.	Immunize.
Newark	All in small inst. Exposed in large inst.		All pos.	KL absent.	
Waltham	Sometimes all exposed, all inflamed ths.	In hosp. cult. from n. and th. of all adm. to S. F. Ward.	All pos.	2 negs. from infect. parts.	
Seattle	Clin. symp. ths.	No.	Cult. from those show lesions.	10 days aft. mem.	Immunize.
Manchester . . .	Clin. symp.; watch exp. 2 weeks.		Th. only.		
Wisconsin . . .	Clin. symp. n. & th.	Should be fr. chronic n. & th.	All pos. n. & th.	KL abs., or 14 dys. aft. recovery.	Cult. fr. all chronic n. & th. immunize.
Fall River . . .	Clin. symp.	Clin. symp.	Isolate suspects.	Children from houses not plac. all'd to ret. to school after 2 weeks.	
St. Paul	Depends on phys.	If possible.	Yes.	KL absent.	Immunize.
Lowell	Depends on phys.			Depends on phys.	
Los Angeles . . .	No, isol. pt. & disinfect.		Pos. n. & th.	KL absent.	
Iowa	Isol. pt. & disinfect.	No.	No.	Clin. hist. & appearance.	
Lawrence	"				
Cleveland	"				

Springfield: isolate cases and watch for new ones. No recognized procedure. In one school, 40 cultures taken, pos. isolated, released on two negs.

No such cases:

Fitchburg.
Reading (rel. 2 weeks after memb.).
New Bedford.
Chicopee.
Camden (close sch., phys. cert.).
Lynn.

Answers obscured:

Chelsea.

Other places, no answer.

	A.	*B.*	*C.*	*F.*	*G.*
Minneapolis	Isolate on symptoms.				
Oakland	Th. exposed only.	No.		Phys. statement.	Isolate and fumigate.
Columbus	All exposed.	No.	Yes.		Observations by alt. phys. Isolate and fumigate.
Salem	Membrane.	No.	Susp.	Neg. cults.	
Salt Lake City	No experience.				
Somerville	Exposed.	No.	Pos.	Phys. cert. for those infected, 2 wks. isol. without developm'nt of dis'se for those exp.	
Minnesota	All, when possible, n. & th.	Yes, n. & th.	KL th.	1 to 3 simultaneous n. & th. cultures neg.	
Willard State Hos.,	All n. & th.	No, unless from infected districts.	All pos.	3 negs. from n. & th. on alternate days.	Immunization.
Burlington	Advise.	Yes.	All pos.	1 neg. cult.	
Quebec	All th.	Yes, but often not done.	Yes, th.	1 neg. from th.	
New York	When not im. All exposed and usually all inmat. are im.	No, immunized.	All pos. unless all are im.	Cultures.	

As a matter of interest and for comparison with the above summary of answers obtained in this country, a summary of replies to three of a set of questions asked of the principal cities in Europe is appended.

These replies were made in response to a circular of questions sent out by the editor of *Annales de Médecine et Chirurgie Infantiles*, and were published in his journal July and August, 1900. The full set of replies may be found in *Pediatrics* for Nov. 1 and 15, 1900. They were called to the attention of the committee by Dr. Shea.

Question 3.— What importance do you attribute to the finding of Klebs-Loeffler bacilli in the mouths of healthy individuals?

Paris.—1. Not diphtheria bacilli, if present in healthy throats.

2. Medium and long bacilli should be tested for virulence. Short bacilli are not important.

3. Dangerous.

Nancy.— Dangerous, if virulent.
Geneva.— Dangerous, if virulent.
Graz.— No importance.
Lille.— No importance.
Rome.— No importance.
Bordeaux.— No importance.
Lausanne.— Often non-virulent.
Constantinople.— May be virulent.
Berlin.— Such bacilli are non-virulent, or the persons are immune.
London.— Cases arise from well persons carrying diphtheria bacilli.

QUESTION 4.— Upon what do you base the determination of the period of isolation of diphtheritic patients?

Paris.—1. Disappearance of bacilli.
2. Disappearance of bacilli.
Geneva.— Disappearance of bacilli.
Paris.— 3. Several days after recovery.
Naples.— Two or three weeks. Advises culture.
Rome.— Fifteen to twenty days after disappearance of membrane.
Berlin.— After clinical symptoms.
London.— Three weeks after clinical symptoms.
Lille.— Eight days after clinical symptoms.
Nancy.— Until bacilli disappear or two weeks after clinical symptoms.
Bordeaux.— When general health is re-established.
Lausanne.— Three weeks.
Graz.— Five to eight days after clinical symptoms.
Stockholm.— Until bacilli disappear, but isolation is not maintained if they remain more than five or six weeks. Disease has, however, been spread in several instances by cases released after five or six weeks, when bacilli still present.

QUESTION 5.— Do you favor the establishment of special institutions for the reception of convalescent diphtheria patients because the bacilli of diphtheria are found in the throat for a long time after the disappearance of the clinical symptoms?

Paris.—1. Approves.
2. Approves.
3. Approves.
London.— Approves.
Nancy.— Approves.
Lausanne.— Approves.
Berlin.— Approves in theory, but considers impractical.
Stockholm.— Approves in theory, but considers impractical.

Bordeaux.— Approves in theory.
Geneva.— No objection.
Rome.— Superfluous.
Lille.— Superfluous.

It is evident from the foregoing summary that sufficient information was not received in answer to our inquiries to permit our coming to any satisfactory conclusion as to what should be done with persons infected with diphtheria bacilli. We therefore decided to ask the co-operation of a number of laboratory workers, in order that more exact data might be obtained, on which we could reasonably hope to base a satisfactory report.

We sent out circular letters inviting co-operation to the following laboratories: —

Cities: Baltimore, Buffalo, Boston, Brookline, Chicago, St. Louis, San Francisco, Worcester, Newton, Providence, Pittsburg, Philadelphia, Washington, Rochester, Syracuse.

States: Minnesota.

Provinces: Ontario, Quebec.

Hospitals: Willard State, Johns Hopkins.

Promises of help were received from Providence, Brookline, Newton, Lowell, Worcester, Springfield, Minnesota, Washington, Ontario, Boston, Willard State Hospital, and from Dr. Theobald Smith.

At present we are waiting until the winter's work slacks up sufficiently to give time for these examinations, and mean time we are trying to get the whole matter well organized.

Meanwhile the committee regrets to have to ask for another extension of time while the investigation is in progress.

THE CHAIRMAN.— The report of the committee is now before the Association for discussion.

DR. PALMER.— Mr. Chairman, I should like to ask Dr. Hill a question in regard to those cases reported as having the germs in the throat, but as not having been exposed, and being regarded as well persons. Does he know what classes of cases were tested? What I mean is, Were they school-children or were they ordinary people about their daily work?

Dr. Hill.— The best figures we have were from Dr. Chapin, so I will ask him to say exactly where they came from.

Dr. Chapin, Providence.— I think nearly all classes of people were represented. A good many of them were persons in institutions, but there were a good many children in public schools. At the time, there was diphtheria in the city. Most of the bacilli were found in institutions, comparatively few among school-children.

The Chairman.— Has Dr. Prescott any experience he would like to mention?

Dr. Prescott.— Dr. Durgin wants me to tell of the experience I had in the Little Wanderers' Home this winter.

Just before Thanksgiving a child came in from one of the suburban towns, and at the end of twenty-four hours was sent to the hospital as a case of virulent diphtheria. That was on a Thursday. On Monday the assistant matron and another child came down with diphtheria, and were sent to the hospital. I then began to take cultures from all the children. For reasons of the government of the Home, I did not give them antitoxin, although I believe that would have been a good thing to do. After the first round was made, we obtained between 20 and 25 positive cases of diphtheria, with a number of cases that are called "Culture Requested." Those are cases where the germ is similar to the KL bacillus, but is not exactly the same; and we thought that in an institution the cases should be isolated. So they were all isolated, just the same as the positive cases were. We kept on taking cultures, through the courtesy of Dr. Hill, who provided us with all the serum we wanted. He must have been very tired before we got through, because he was running the Parental School at the same time; and he had 1,500 cultures there, and almost as many from our Home. But I am happy to say that in six weeks every positive case was cleared up, and we have not had a case of clinical diphtheria since the one was sent to the hospital on the Monday after the first case appeared. I think that shows the advantage of isolating all these cases.

Dr. Shea.— Mr. Chairman, I should like to ask Dr. Prescott how many of those 25 cases they found developed into diphtheria.

Dr. Prescott.— We never had a case develop into diphtheria.

I said we did not have a clinical case of diphtheria from the time the second group of cases went to the hospital. That was on a Monday. But we kept on taking cultures between five and six weeks, and once in every little while a patient who had never had bacilli in the throat before would have the bacilli; and then we would have to have that child upstairs, and kept upstairs until we got two negative cultures.

Dr. Smith.— Mr. Chairman, I should like to ask Dr. Prescott what the relative virulence of those bacilli was.

Dr. Prescott.— I don't know: perhaps Dr. Hill can tell. I don't think he had time, though, to do anything of that sort.

Dr. Hill.— The work came too fast this year, Dr. Smith. We could not pretend to handle that point.

Dr. Prescott.— There was not any question of the two cases that went to the hospital; and the case that came in first was a patient that was very sick with diphtheria, and there was no doubt of the virulence of the germs. No patient died. As a matter of fact, no patient that I have had go to the hospital has died since antitoxin came in. I consider that, if you give sufficient antitoxin within twenty-four hours from the time of the first symptoms, there is very little danger of the patient's dying.

The Chairman.— The subject is still open for discussion.

A Member.— I should like to ask if this committee made any inquiries in regard to a systematic use of antitoxins or prophylactics or, where one case broke out in a family, if anything was done in the way of using antitoxins or prophylactics for the rest of the family.

Dr. Chapin, Providence.— Mr. President, we thought our field was large enough without taking in the question of antitoxin. We did not consider that at all.

Dr. Hill.— One man did make a note on that, and said that out of sixty-six positives only three developed the disease. These three died. He immunized all the others at once, but for some reason his antitoxin gave out; and these three escaped immunization and came down with and died of the disease, but none of the other positives developed it. It was not in reply to a question, but was volunteered.

Dr. Goodwin.— I was going to ask Dr. Hill or Dr. Chapin, where

the practice is that they require two negative cultures, how much time is supposed to elapse between the taking of the first and the second culture.

Dr. Hill.— We simply require that they should be on different days, that is all. The average time is about two to three days. It would depend, of course, on the physician who acts as medical agent.

Dr. Worcester.— Dr. Hill, in Boston the second culture is made by your examiner?

Dr. Hill.— By our agent, a physician.

Dr. Worcester.— I should like to ask Dr. Prescott whether, in these twenty-five or thirty cases that showed the presence of Klebs-Loeffler bacilli after the first cases that developed diphtheria, antitoxin was used.

Dr. Prescott.— No antitoxin was used at all.

Dr. Worcester.— I did not understand. I wanted to be sure about that.

Dr. Prescott.— I contented myself with taking cultures and isolating them, and not using antitoxin. If I had my own way, I should give antitoxin to every child in the Home as soon as a case appeared, and to every applicant of the Home before it was admitted to communion with the rest of the children, as they do at the Children's Hospital. I think the experience there has definitely proved that antitoxin is a preventive of diphtheria starting up in a hospital. They have had but one case come up in several years since they have given to every child who has been admitted a dose of antitoxin.

Dr. Chadwick.— Waltham had an experience which would be of interest in this regard. We have had an epidemic there since the beginning of the school year. In fact, we have had over 400 cases since the first of February. About 250 of those have been since the opening of the schools in September. The epidemic gradually became greater and greater, till about the first of December we had about 50 patients in Waltham, which has, as you know, about 24,000 or 25,000 population and about 4,000 school-children. At about the first of December, school inspectors were appointed; and every school child in both the public and private schools was examined, and cultures taken from each one that showed a red throat or a nasal discharge.

From those cultures 22 showed the Klebs-Loeffler bacillus. Some of these children had very slight evidence of disease, only a red throat or, possibly, a very slight nasal discharge. These were excluded and quarantined in all except one or two instances, where the evidence was so slight that we simply excluded the child from school until two negative cultures were obtained. The result of that has been very remarkable, I think, in stopping the epidemic. At the present time we have only about 12 cases in town. In several instances we have found, or feel confident, at least, that these children that had very slight evidence of disease — in fact, no evidence except the redness of the throat or the slight nasal discharge — were the cause of several cases of severe diphtheria.

THE CHAIRMAN.— I think it might be very interesting to the Association to have Professor Smith state his opinion in regard to the different degrees of virulence between the bacilli found in persons sick and on recovery, and also between those having the clinical symptoms and those without. Dr. Theobald Smith.

DR. THEOBALD SMITH.— Mr. President, I think that you have given me rather a large programme. I feel that I am quite unable to answer all the questions proposed. I have been a rather close student of the diphtheria bacillus for the last five or six years,— but mainly from the laboratory point of view,— and the question of relative virulence has been of special interest to me. It is a problem which applies to all bacteria, and of course it is a very important one when applied to the diphtheria bacillus. In 1896 and 1897 I tested very carefully, with all the methods then at our disposal, about 42 different cultures which came from different parts of the State to the laboratory of the State Board of Health. This test was made in such a way that we were able to determine the difference between the toxin-producing power of the different bacilli. It was easy to classify the bacilli into such as produced a very large amount of toxin (which formed a very small class), such as produced a medium amount of toxin, and those which produced a slight amount of toxin; but all of the 42 were virulent bacilli, and they had all the characteristics of the virulent type. There were 4 others isolated, which, with the microscope, were classed as pseudo-diphtheria bacilli, and also

proved to be such when they were tested. At that time I almost doubted that there were non-virulent bacilli which closely resembled true diphtheria bacilli under the microscope, but last year Dr. Denny sent me a culture taken from a patient quarantined for some months. I examined the culture with the most improved methods at our disposal, and found it absolutely without virulence. There was not the slightest effect upon guinea pigs from the large doses that were injected. Soon after another case came under our observation. Dr. Richardson, from Marlboro, had a case in which the bacilli were in the throat fully five months after the patient had recovered from a mild case of diphtheria. I tested the bacillus from this case also by passing it through a series of cultures in order to augment the toxicity, then tested it, and found not the slightest trace of toxicity, although these bacilli had all the characters of the true diphtheria bacillus. I think that one of the important things for the committee to do is to include the matter of testing the virulence and toxicity of diphtheria bacilli in their programme. It is not an easy task, and all laboratories should contribute to this work. I shall do my share of it. I hope to test all the cultures of bacilli that reach me from throats that are found without disease, and also those that are running more than three months after all traces of disease have disappeared. I think in this way we may be able to come to some conclusion as regards the relative virulence of bacilli and its possible disappearance. The question is, at best, a complicated one. The admirable report of the committee shows this very clearly, and it seems to me that there is a great deal still to be discovered.

To return to the illustration that Dr. Prescott gave, I think it is a most remarkable one. If there were 25 cases in which certain bacilli were present in the throat without subsequent disease, it seems to me almost a proof that these bacilli cannot produce diphtheria. At least 50 per cent. of such cases should come down with diphtheria later on, as, I think, has been observed in European institutions where diphtheria bacilli were detected at the beginning of an epidemic, and where such infected cases, slowly one after the other, came down with the disease afterwards. It is a problem which I think cannot be solved at present why 25 individuals, in the earlier years of life, and hence the most susceptible, should have diphtheria

bacilli in their throats, morphologically speaking, and yet have no disease. I regret that the link in the chain of evidence which refers to their toxicity is not at hand.

I think there is one point, if I may be allowed to digress from the questions that have been propounded to me, that this Association should take up; and that is a popular instruction in regard to the manner in which children should take care of their fingers and their mouths and noses in their association with one another. I doubt whether the problem of diphtheria is ever going to be solved unless we begin at that end as well. It seems to me that it is a subject which is pertinent for preventive medicine to take up; namely, the popular instruction, among the children of the State, concerning the manner in which the bacilli may be transmitted from case to case.

Mr. Coffey.— Mr. Chairman. Dr. Smith, I should like to ask you a question, if you please. Have you formed any opinion as to what effect these non-virulent bacilli might have upon the human throat if it was exposed? In other words, these non-virulent bacilli are tested upon guinea pigs. Might it not be possible that they would not affect a guinea pig, but, if a child of susceptible age was brought in contact with the bacilli, it might be affected? Had you formed any opinion as to that?

Dr. Smith.— I think — my opinion is based upon a long experience with pathogenic bacteria — that those bacilli would be harmless to children. It is not a question which we can demonstrate, because the human subject should not be experimented upon: hence we have to use the data which come to us from the study of other infectious diseases. I am fairly convinced that those diphtheria bacilli which produce trace of disease on guinea pigs, when injected in large doses, are harmless to man.

Dr. Hill.— If I may ask Dr. Prescott a question. Do you remember, doctor, about those 25 positives, whether they were those cards marked positive or those marked doubtful?

Note.— In conversation with Dr. Prescott, after the meeting, he consented that I should add here the fact that these 25 positive cases not sick were all exposed to the sick diphtheria cases. Since the Little Wanderers' Home contains about 100 inmates, and all of these were exposed, these 25 positive cases formed about 25 per cent. of the total exposed. Now Dr. Chapin, of Providence, has

shown by figures extending over several years that those exposed, who have diphtheria bacilli in their throats, form usually about 50 per cent. of the total exposed persons. About one-half of these develop the disease, the remaining half (one-fourth, say, of the total number exposed) remain well. This Little Wanderer epidemic is peculiar, then, not so much because 25 per cent. of the exposed were infected, but because another 25 per cent., which might have been expected to be infected, escaped, and the 25 per cent. infected failed to develop the disease. The presumption is that these persons are immune, since the virulence of the bacilli, coming from clinical cases, may be considered as very probably existent, certainly, in a large proportion of these well persons exposed and carrying diphtheria bacilli.

Dr. Prescott.— I only spoke of those marked positive. Of those marked "C. R." I don't remember how many there were. I guess every child there had "C. R." some part of the time. There were between 100 and 115 children in the Home; and I think the larger proportion of them were "C. R." at some time.

Dr. Hill.— I might say that about half of the Parental School children gave "C. R." cultures. On going out there after them, I found that some of the children were packed in the rooms where they slept. Really, you could walk all over the room on the beds without any danger of touching the floor. It was from those rooms that we got this particularly large number of "C. R.'s." That is to say, if three or four boys in the lot had it to start with, there is every reason to believe it would be spread to every one else in the room within a few hours.

Mr. Coffey.— What is "C. R."?

Dr. Hill.— "C. R." is our laboratory abbreviation for "Culture Requested." That is, if a culture for diagnosis is uncertain for any reason, we ask for another culture. In the case of epidemics in institutions, "C. R." always means the presence of that organism which was often called the "nose bacillus" in previous days, and which we now call for short the "double-header." It occurs in a double cone shape, two cones with the bases together; and a great deal of work and discussion has been caused by it. The latest work seems to show that it is at least connected with the diphtheria bacillus,— that is to say, that it may be usually a non-virulent form of it, but that it is sometimes virulent,— and, therefore, we consider that in institutions, on the chance of its being virulent, it is better not to take

those chances, but to isolate the person carrying it. When it comes to us for diagnosis, we simply request another culture. We don't call it positive when the culture is for diagnosis.

Dr. Prescott.— We isolated all those cases just as if they were positive cases, but we did not keep them as long isolated if the next culture was reported negative.

Dr. Chase.— Mr. President, I might say just a few words in regard to the case Dr. Smith referred to, of bacilli sent in by Dr. Denny from Brookline. I know something about that case, for I was one of the two physicians who saw it. The child had the clinical signs of diphtheria, and also had some fever and other symptoms, so that the nurse was employed for a number of weeks. When the culture was sent for Dr. Smith's opinion, the child had been quarantined, I think, some ten weeks; and that is Dr. Denny's recollection also. Two weeks after that,— twelve weeks,— the child was released, and allowed to go to school. We wanted first the opinion of one of the highest authorities of the State before releasing it from quarantine. At that time we had made our guinea pig tests in the usual way, and found no virulence, as far as the pig would show it. But such cases as that are constantly arising, not only in our town, but in every town; and I should be sorry if we should go away this afternoon without any practical results, any help, from Dr. Smith's remarks to us. If it is in order, Mr. President, I should like to make a motion, if that is the way to bring it about, that Dr. Smith be requested by the Association to prepare for us a circular of suggestions on those two points that he referred to specially: first, how we are to determine the virulence of the germs,— we are doing it now in our way in Brookline,— and the other question, what we shall do when we find the germs are non-virulent, whether let that child return to school at once or keep him at home, and let his brothers and sisters return. We want his knowledge for our guidance on that; and then the other matter he referred to, in what way can these children prevent exposure to themselves and others by their hands, etc. I think it would be a very valuable thing for all of us if we had the benefit of Dr. Smith's knowledge. So I would like to make that motion, Mr. President, that such a circular be prepared. I will not give you the wording of it. I should like the President to express the wording of it. I think you have the idea.

Dr. Prescott.— I second the motion.

Dr. Smith.— I should like to state that the committee that now has this matter in charge is, in my opinion, perfectly competent to take up these problems. I shall do what I can in my small way to assist it, but I think the committee is fully able to manage them. The testing of diphtheria bacilli is a matter which takes some time, and there might be some short method worked out which would simplify the testing of the virulent bacilli. I hope to assist in working on this matter whenever time allows, but I think there are others in a position to carry on such investigations. At any future time we can compare notes as to the best methods that have been worked out. It seems to me that, if the Association wishes to have any such circular drawn up, it should be referred to the standing committee on diphtheria.

Dr. Chase.— Mr. President, I withdraw that motion.

The Chairman.— Are there any other remarks to be made upon this report?

Dr. Chase.— Mr. President, will it be understood that the committee already in existence will assume that in addition to its present duties? If not, I move that that shall be done.

The Chairman.— You hear the motion of Dr. Chase, that the additional duty mentioned shall be added to the duties of the already existing Committee on Diphtheria Bacilli in Well Persons. Does any one second the motion?

The motion was seconded by Dr. Prescott, and adopted.

Dr. Chase offered the following vote, which was unanimously passed: —

Voted, That, recognizing the ability of the Committee on Diphtheria to deal with every aspect of the question, the said committee is requested: —

(1) To prepare a few suggestions that health officers may print as a circular and issue to parents, teachers, and others for their instruction in the hygiene of children with special reference to their protection from diphtheria. These suggestions, as recommended by Dr. Theobald Smith, should emphasize the importance of clean hands before eating, and such other measures as the committee may deem of value.

(2) To prepare for the guidance of health officers suggestions as to the importance of testing, as quickly as practicable, the virulence of bacteria bacilli in persons in whom the clinical symptoms have been very slight or entirely lacking, thus preventing, whenever possible, much unnecessary expense and hardship.

THE CHAIRMAN.— Does any one move the continuance of this committee as asked for?

DR. PRESCOTT.— I move the continuance of the committee as asked for.

The motion was seconded and adopted.

THE CHAIRMAN.— Is the Committee on Nominations ready to report?

MR. PILSBURY.— Mr. President, there being a long list of talented gentlemen comprising the membership of this Association and having the necessary qualifications, the committee took considerable time in order to prepare its report, for which we trust we may be forgiven. A majority of the committee desires to assume the responsibility of having nominated one of its own members as a candidate for office. I say this in deference to the gentleman's modesty. The committee presents the following report: —

LIST OF NOMINEES.

President.
HENRY P. WALCOTT, M.D.

Vice-Presidents.
SAMUEL H. DURGIN, M.D. SAMUEL W. ABBOTT, M.D.

Secretary.
JAMES C. COFFEY, of Worcester.

Treasurer.
JAMES B. FIELD, M.D., of Lowell.

Executive Committee.
(For two years.)
W. H. CHAPIN, M.D., of Springfield. F. W. KENNEDY, M.D., of Lawrence.
D. S. WOODWORTH, M.D., of Fitchburg. W. S. EVERETT, M.D., of Hyde Park.
WALTER C. KITE, M.D., of Milton.

On motion of Dr. Prescott, duly seconded, it was voted that the Secretary be authorized to cast the ballot of the Association for the list of officers thus nominated.

THE CHAIRMAN.— The next paper on the programme is: —

ON THE DRAINAGE, RECLAMATION, AND SANITARY IMPROVEMENT OF CERTAIN MARSH LANDS IN THE IMMEDIATE VICINITY OF BOSTON.

BY WILLIAM LYMAN UNDERWOOD,

LECTURER IN THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY AND MEMBER OF THE BOARD OF HEALTH OF BELMONT.

It has long been recognized that the existence of " wet, rotten, and spongy lands " in the near neighborhood of towns and cities may constitute a menace to the public health; and special attention has been drawn to such areas within the last three years, since it has been established with tolerable certainty that the mosquitoes for which they too often furnish a breeding-place may become effective vehicles of malarial or intermittent fever. In almost every town in the State are to be found undrained areas of wet, sour, and swampy lands which in many ways are a nuisance and more or less injurious to the public health. Pools of stagnant water are frequently found upon them, in which may be bred myriads of mosquitoes whose existence in any neighborhood is a damage quite apart from the fact that they may in all probability become the effective carriers of the germs of intermittent fever.

From such areas arise foul odors of decaying vegetation; and in the colder months of spring and fall the air, heavily laden with moisture, tends to impart to the surrounding neighborhood a cold and penetrating chill detrimental to the public health. Frequently these lands cover a very large tract whose ownership is divided among many individuals. Very often the territory may cover lands lying in separate though contiguous towns.

The question arises, How can these conditions be remedied or the dangers from them be minimized? If it is possible to drain these spongy lands and so bring the soil back to a sweet and wholesome condition, who is to do the work, and at whose expense is it to be done? An individual owner generally cannot work to advantage unless he has the co-operation of his neighbors. How to bring about a

unanimity of purpose and action on such a question is often a very difficult problem to solve, especially when it involves the possibly conflicting interests of two or more different towns. While it may in most instances be impossible to obtain concerted action through individuals, there is fortunately, if properly applied, a method by which much good may be effected; and that is through the local board of health — if the lands in question lie within one town — or by the united action of the boards of health of two or more towns whose interests are involved, provided it can be shown that the areas in question are detrimental to the public health. The laws which the State of Massachusetts has enacted to deal with such conditions are positive and plain, and briefly as follows: —

Lands which are wet, rotten, and spongy, and offensive to persons residing in their vicinity, or which are injurious to the public health, may be deemed a nuisance; and, upon a hearing and petition, such nuisance may be abated. A board of health may also determine who shall bear the expense of making such improvements and the keeping of them in repair, whether it shall be the city, town, or persons benefited thereby.

As a single illustration of what has already been accomplished along these lines in one case, and to show that still further steps seem absolutely necessary for the safety of the public health, a tract of territory will be considered, situated within five miles of the State House in Boston, lying in and between the cities of Cambridge and Somerville and the towns of Arlington and Belmont, and known as the "Fresh Pond Marshes." It is the purpose of this paper to describe and illustrate the condition of these marshes as they now exist and as they existed before certain sanitary improvements recently made by the Boards of Health of Belmont and of Cambridge had been carried out. In order to give a clear idea how these conditions were brought about, it will be desirable to state a few facts concerning the early history of the Fresh Pond Marshes.

In 1856 the Cambridge Water Company first began to use the waters of Fresh Pond for the city supply, and their charter also granted them the right to take the waters from Little and Spy Ponds and Wellington Brook. During that year F. W. Bardwell (a member of the Lawrence Scientific School) was employed to ascertain the

amount of water available for the city's use. He made careful calculations, and found that the average discharge from Fresh Pond and through Alewife Brook (see map) was a little over 2,000,000 gallons daily. From Spy and Little Ponds and Wellington Brook it was about 10,000,000 gallons daily. He reported that by building a dam across the culverts under the Lexington Branch Railroad the waters from these ponds and the brook could be forced back into Fresh Pond. It is not clearly shown just when Fresh Pond began to be supplied in this way, but it was probably some time before it became necessary to do so. In a report of 1870, however, the following appears: —

"A new gate and gatehouse have been built at the outlet of Fresh Pond, and flashboards have been erected on Alewife Brook where it passes under the Lexington Branch Railroad. These flashboards were rendered necessary, not only to secure the water flowing from Spy and Little Ponds, by conducting it into Fresh Pond, but also to enable the fish to escape from the pond to the ocean. There had been no water flowing from Fresh Pond for several months, while there was a constant flow from Spy and Little Ponds. By the dam at the railroad crossing the tide is effectually shut out from all the ponds, and the water from Spy and Little Ponds is carried directly into Fresh Pond."

This system was evidently used until 1873, when two sewers were allowed to empty into Alewife Brook,— one at Spruce Street and another at Concord Avenue. In order to avoid contamination of the water supply of Cambridge by their sewage, the outlet of Alewife Brook was then permanently closed by filling in with dirt, and sheet piling was driven in across the brook at Concord Avenue. As a further safeguard, tide-gates were built at Broadway in Somerville, to prevent the tide-water from backing the sewage upon the meadows. As Cambridge, however, could not afford to lose the amount of water which she had been getting from Little and Spy Ponds and Wellington Brook, she built in 1875 a conduit to carry this supply directly from those ponds and Wellington Brook into Fresh Pond. (This is shown upon the map.) For a number of years this system appeared to be satisfactory; but, with the rapid increase in the population of Cambridge, it soon became evident that a larger water

supply was necessary. It also became clear that the conduit water was being badly polluted; for Wellington Brook, with its drainage area of 2,500 acres (the greater part in a state of high cultivation and heavily manured), was becoming a serious danger. In 1879 the Cambridge Water Board had borings made all over the territory between the meadows and Fresh Pond. As a result, they found a rapid undercurrent of water setting from the marshes to the pond; and in their report for that year they stated that it was very important that these meadows should be kept clean, in order to avoid contamination of the public water supply. The marshes are to-day in a worse condition than they were then, and, if the opinion of the Water Board was correct, must still menace the purity of the waters of Fresh Pond. To avoid further contamination and to meet the growing demand, Cambridge in 1887 began to take its main supply from Stony Brook in Waltham, and Little and Spy Ponds and Wellington Brook were abandoned as sources of water supply.

The condition of the meadows at this time, from a sanitary point of view, was far from satisfactory. Naturally, the channel of Wellington Brook, through disuse, had become considerably obstructed below the point where its water was diverted by the conduit. Rank weeds and other growing vegetation in some places completely filled the bed of the stream. For a number of years the farmers had entirely neglected the land in this vicinity. Prior to 1880, and as long as the ice business of Fresh Pond was in a flourishing condition, these marshes were cared for, the channels of the brooks were annually cleaned out, and the whole meadows thoroughly ditched. Heavy crops of meadow hay were harvested from them, and found a ready market with the ice-men, who used large quantities for packing in their ice-houses. The Fresh Pond Ice Company alone bought 100 tons of hay a year, frequently paying as high as $20 a ton for it. In 1888 the last ice-house was removed from the pond, and from that time until the present (a period of some twelve years) no attention has been paid by the owners to the drainage of this large territory. Year by year the water has been rising higher and higher upon the fields until stagnant pools have come to exist all summer long, and offensive odors of decaying vegetation are given off where twenty years ago crops of good meadow hay were cut annually. Malaria has

FIG. 1.— A 10-inch pipe located in Belmont, 700 feet from the Cambridge line. Through this pipe was flowing, on July 27, 1900, all the water from Wellington Brook at that time. The bridge on Hittinger Street was being repaired, and the water was temporarily cared for in this way. It will be seen that a much smaller pipe would have answered the purpose. (Compare this with Figure 4 taken on the same day.)

FIG. 2.— Looking south-east, from bridge on Hittinger Street, July 27, 1900, showing pool in Belmont into which the water from the 10-inch pipe shown in Figure 1 was flowing. This pool was 3 feet deep, and well indicates the lack of proper drainage.

FIG. 2a.—The same place shown in Figure 2, Nov. 22, 1900, and after heavy rains. It will be seen how the water has been lowered in spite of the rains and drawn off by simply clearing out the channel in Cambridge territory. On the right bank will be noticed the roots of the rushes which are to be seen in Figure 2 growing luxuriantly.

FIG. 3.— July 27, 1900, looking east from Wellington Street. The channel of Wellington Brook is filled with rushes. Within half a mile, in Belmont, is a school-house from which there are more absences relatively from sickness than from any other school in that town.

FIG. 3a.— Nov. 22, 1900, same view as above, after the new channel had been made.

FIG. 4.— July 27, 1900, a 4-foot pipe and culvert under the Fitchburg Railroad and Central Massachusetts tracks, 1,200 feet below the 10-inch pipe shown in Figure 1. This pipe was standing almost full of water, while the 10-inch pipe further up the stream was not half filled, though carrying all the flow of Wellington Brook. At the lower end of the culvert rushes were growing and filling the channel. These and other obstructions further down the stream were holding the water back and keeping the pipe full.

FIG. 4*a*.— Nov. 22, 1900, from the same point as Figure 4, but after the channel had been cleaned out. It will be seen that the pipe is but half-full of water, though the view was taken after a heavy rainfall. When the brook was first cleared out, there were only five inches of water flowing through the culvert.

Fig. 5.— July 27, 1900. An obstruction of willow-trees growing directly in the bed of Wellington Brook. The surface of the water is covered with a thick scum of duckweed, with the exception of the dark space in the centre, into which, just before the picture was taken, a stone had been thrown.

FIG. 5*a*.— Nov. 22, 1900. From the same point as Figure 5, but showing the new channel. Just beyond the willow-tree and to the left was situated formerly the gateway that carried the water through the conduit into Fresh Pond. (See map.)

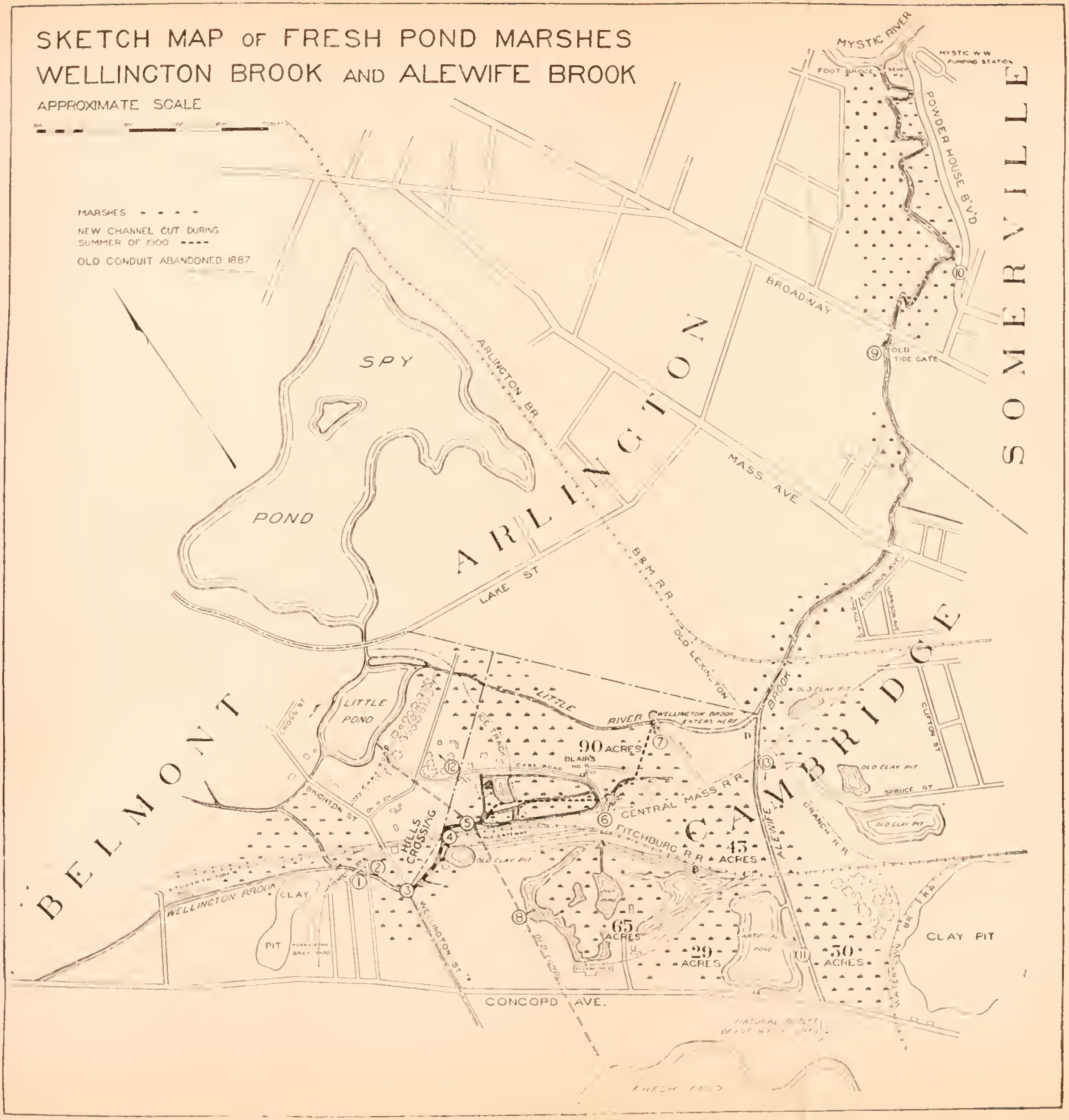
SKETCH MAP OF FRESH POND MARSHES
WELLINGTON BROOK AND ALEWIFE BROOK
APPROXIMATE SCALE
MARSHES
NEW CHANNEL CUT DURING SUMMER OF 1900
OLD CONDUIT ABANDONED 1887
SPY
POND
LITTLE POND
ARLINGTON
BELMONT
CAMBRIDGE
SOMERVILLE
MYSTIC RIVER
MYSTIC W.W. PUMPING STATION
FOOT BRIDGE
POWDER HOUSE B'V'D
BROADWAY
MASS. AVE
ARLINGTON BR.
B&M R.R.
OLD LEXINGTON
LAKE ST
OLD TIDE GATE
LITTLE RIVER
WELLINGTON BROOK ENTERS HERE
90 ACRES
BLAIR'S
CART ROAD
CENTRAL MASS R.R.
FITCHBURG R.R.
45 ACRES
65 ACRES
29 ACRES
30 ACRES
ALEWIFE BROOK
BRANCH R.R.
OLD CLAY PIT
SPRUCE ST
CLIFTON ST
CROSS ST
BRIGHTON ST
HILLS CROSSING
WELLINGTON ST
WELLINGTON BROOK
CLAY PIT
CONCORD AVE.
CLAY PIT
ICE TRACK

Fig. 6.— July 27, 1900. A stagnant pool, the surface of which was covered with green scum. After the new channel was constructed, this pool was lowered about 2 feet. In the winter of 1899–1900, on a number of occasions, the water in this vicinity rose so high that it covered the roads and prevented children living at Blair's house (see map) from attending school.

FIG. 7.— July 27, 1900, the mouth of Wellington Brook where it enters Little River. From this point to Wellington Street the new channel was constructed. It will be seen, by referring to the map, that here the stream had become completely obstructed. For some distance the water of the brook had to soak its way through the soil to Little River.

FIG. 8.— Dec. 8, 1900, looking east, and showing conditions still existing at the worst spot on the marshes. In this section there are 65 acres, bounded on the north by the tracks of the Fitchburg Railroad, on the east by the tracks to the factory of the Boston Packing and Provision Company, on the south by Concord Avenue, and on the west by high land, from which this view was taken. Most of this territory is under water throughout the entire year. Formerly the greater part of it was covered with a growth of maple-trees, but these have all been killed by the gradually rising water. At points *A*, see map, directly under 6, and *B* (more to the right), culverts used to drain this section into Wellington Brook; but now these waterways have been filled in, and the only outlet is at *C* (see map, point on railroad tracks north of Artificial Pond). From the north side of the Fitchburg Railroad tracks, at this point, the water has to find its way across the marshes as best it can; for there is no channel for it.

FIG. 9.— The old tide-gate house, at Broadway, in Somerville. Built in 1872 and abandoned in 1896.

FIG. 10.— Looking north from Powder House Boulevard, and showing marshes between Broadway and the Mystic River. If tide-gates were constructed at the point where the foot-bridge crosses Alewife Brook (see map) near its junction with the Mystic River, this marsh land could be changed into a lagoon, in which the brook waters could be stored during the period of high tide in the river. By this means it is probable that the water-table of the Fresh Pond marshes could be lowered 3 feet.

FIG. 11.— The shore of Artificial Pond. (See map.)

FIG. 12.— A view near the marshes, showing the agricultural possibilities of this locality.

FIG. 13.— The unreclaimed portion of the marshes as it exists to-day. Looking southeast from the Massachusetts Central tracks, December, 1900. Within half a mile of this swampy area there are located 1,161 dwelling-houses. 128 of these are in Belmont, 201 in Arlington, 307 in Somerville, and 525 in Cambridge.

FIG. 14.— Looking east along the south bank of Wellington Brook, in Belmont, about a quarter of a mile above the point where it passes under Concord Avenue. The brook is hidden by the shrubbery to the left. In the lower right-hand corner is seen a portion of a lily pond, and in the background is a meadow kept sweet, dry, and fertile by means of proper drainage.

Fig. 15.— The lily pond, a part of which is shown in Figure 14. Here are grown aquatic plants, including six hardy varieties of water lilies that bloom from May to October, and require no special care. In the water are hundreds of goldfish that feed upon the larvæ of mosquitoes, and serve to keep this insect pest in check. In such ponds these fish thrive and multiply, surviving even the coldest winters of the locality.

Figures 14 and 15 illustrate what might be accomplished on the Fresh Pond marshes by proper drainage and care.

crept in, and the whole district has threatened the health of the surrounding towns. It was this condition of affairs that the Board of Health of Belmont was called upon to investigate.

It was at once apparent that the town by itself could take no effective steps to alleviate the trouble, as the backing up of the waters of Wellington Brook upon Belmont lands was due to obstructions further down stream within the limits of Cambridge. Co-operation with the Board of Health of that city seemed to be the only remedy; and early in the fall of 1900, through the united action of the Boards of Health of Cambridge and Belmont, a considerable area of worthless and unwholesome territory in the vicinity of Hill's Crossing was readily and successfully reclaimed.

For this purpose a broad new channel, 10 feet wide and 4 feet deep, was constructed from the point where Wellington Brook enters Little River to the Belmont line, a distance of half a mile. This has so thoroughly drained the immediate district that the water level has in some places sunk more than 40 inches. Farther up the stream in Belmont, lands which were under water last summer — one of the dryest seasons in many years — have been so thoroughly reclaimed that they are now dry and available for cultivation. The map and photographs will serve to show the extent and character of this work better than any merely verbal description could possibly do, and to them the reader is referred for detailed information.

The work which has already been done through the combined action of the Boards of Health of Cambridge and Belmont has cost about $1,600, of which Cambridge's share was $1,100, and Belmont's $500. No assessment upon any of the landholders has been made by either of the boards, as it was held that these unsanitary conditions were brought about through natural causes, and that their removal was for the common good of the public at large.

While Belmont has no further cause of complaint in so far as her own lands are directly concerned, that town is nevertheless near enough to a portion of territory which still remains undrained to feel its evil effects. It is to be hoped that some method will soon be devised whereby the towns and cities chiefly concerned (Belmont, Arlington, Cambridge, and Somerville) may co-operate and adopt some definite measures concerning the sanitary treatment of these lower

marshes for their mutual benefit, and also for the benefit of the public at large, as the condition of these may materially affect the health of other near-by towns.

There is still much to be done before some of the neighboring territory can be brought into a healthful and useful state. To accomplish this, the co-operation of Arlington, Somerville, and Cambridge with Belmont is indispensable. The placing of tide-gates at the mouth of Alewife Brook where it empties into Mystic River would remedy existing evils at comparatively small expense. This whole neighborhood possesses many natural beauties, and, if developed, could be made wholesome and attractive, instead of what it now is, an unsightly area of waste and swampy lands, and a menace to the public health.

A map of the Fresh Pond Marshes and some of the contiguous territory has been prepared under the author's direction, and is shown above. The boundaries of the cities and towns immediately concerned are clearly indicated, as are also the course of Wellington Brook, Alewife Brook, and the location of the Mystic River, as well as of the new channel which has already proved so effective.

Photographs made by the author illustrating what has been done, as well as the need of still further improvements in the lower part of the territory under consideration, are appended. The legend under each will suffice for its explanation. The points where the photographs, Figures 1, 2, 3, etc., were taken, are indicated on the map by corresponding numerals enclosed in circles; and in several cases small arrows adjoining the circles show the direction in which the camera was pointed.

NOTE ON DRAINAGE AND MOSQUITOES.

" After all, the best of the means which may be adopted against mosquitoes will always consist in the abolition of their breeding-places. Small pools with stagnant water can be 'treated,' but it is a great deal better to drain them or to fill them up. Swamp areas must sooner or later be drained. It is perfectly obvious that, the sooner this is done, the better from every point of view, not only from that of human health, but from the increased value of real estate in the neighborhood and from the practical value of the reclaimed land itself. The

time is coming, and rapidly, when this drainage of large swamps will not remain a matter which concerns the individual owner of the land, but one for town or county action, and even for States. The report of T. J. Gardner on the policy of the State respecting drainage of large swamps, published in the Report of the Board of Health for New York, Albany, 1885, although antedating the recent important mosquito discoveries, is well worth reading by all public-minded persons; and the annual reports of the State geologist of New Jersey, for 1897 and 1898, in which the reclamation of the great Hackensack Meadows, near New Jersey City, Newark, and Elizabeth, New Jersey, make interesting reading along this line. Work on these marshes has actually been begun. The solution of this case is taking the form of separate action by cities and their municipalities, each improving the territory within its corporate limits. The city of Newark has a tract of 4,600 acres of marsh within its limits. Jersey City has within its limits 2,086 acres of tide-marsh, and Elizabeth has 2,658 acres. The three cities, therefore, have about 8,700 acres of the 27,000 acres lying between Elizabeth and Hackensack. The sanitary importance of reclaiming these lands is of the greatest; but the capabilities of the improvement plans are also attracting attention on the part of capitalists and business men, who see in these tide-lands valuable sites for manufacturing, industrial, and commercial activity." — *Professor L. O. Howard, Entomologist, United States Department of Agriculture*, "Notes on the Mosquitoes of the United States," p. 63, Washington, 1900.

THE CHAIRMAN.— This paper, gentlemen, is now open for discussion. I notice Dr. Cogswell, of Cambridge, here. Perhaps his experience might be of interest to the Association.

DR. COGSWELL.— Mr. Chairman, I cannot say anything in addition to what Mr. Underwood has told you. I used to be more or less familiar, as he was, as a boy, with portions of the territory, and I have been there many times since; and I can say it is all true in regard to the bad condition that has existed up to the time of the digging of the ditch. I have no doubt that the changes that we have seen on the pictures are actual representations of what has taken place. There is certainly abundant opportunity for further improve-

ment in the other part of the territory. I don't wish to be held up as having any better knowledge of the facts than Mr. Underwood, who, I think, was born there, at any rate has lived there, to my certain knowledge, a great many years.

PROFESSOR SEDGWICK.— Mr. President, I would like to say just one word. It seems to me, Mr. Underwood's work is interesting, mainly from this point of view: It shows that, when two or three neighboring towns choose to co-operate for mutual good, for the common good, they can in many cases do a great deal for a very small sum. Here were two towns. Each might have said that it was the work of the other. Each was inclined originally to say that; but by putting their joint efforts to work they cleaned out that ditch and drained a lot of marshes. It is difficult to realize that a place like this existed so long so near the metropolis of New England,— existed and, in part, still exists there. But I think the thing that is most instructive in it all is the example which it furnishes,— the very excellent example of co-operative work by neighboring towns. It too often happens that neighboring towns are more or less hostile, or that they insist on cavalierly throwing off one upon the other any work that is to be done, even when it can be shown to be for the mutual good. Here is a case in which the city of Cambridge and the town of Belmont got together and did a good, creditable piece of sanitary work. If now the four communities — Arlington, Somerville, Cambridge, and Belmont — should further co-operate, put in those tide-gates and dig a pool or lagoon to hold the water that accumulates between tides, a much greater improvement might be made. I have no doubt there are similar cases in other parts of the State.

THE CHAIRMAN.— This is a most interesting matter for the consideration of every board of health within the State. I can scarcely imagine a town in the entire State of Massachusetts in which there may not be found some stagnant pools and unhealthy marshes, such as have been depicted here this afternoon; and it may be interesting for boards of health to realize that, under our statute law, each local board has the right to examine, give notice, hearings, and then proceed and drain these places, up to the limit of $2,000 in any single instance. Before a dozen years ago this amount of expenditure was

unlimited. It was then, owing to a little difficulty in one of the cities of the Commonwealth, limited to $2,000 ; but up to that extent any board of health may proceed, and do this kind of work which has been illustrated this afternoon. It seems to me, with the increased intelligence now given in regard to the mosquito, that that alone would be sufficient excuse for any board of health to proceed in behalf of the comfort of their citizens in draining these territories, such as has been shown this afternoon. I hope the discussion is not ended, and that there will be more said by those interested in this class of work.

Dr. Smith.— Mr. Chairman, I should like simply to say one word. It seems to me that the speaker has very well brought out the bad influence which our railroads have had upon the natural drainage of the soil. That is quite conspicuous in the chart, and I have noticed it for the past four or five years in making field studies on the prevalence of malaria for the State Board of Health. I have observed in many places in the State how the stagnant pools and stagnant trenches have been created in defiance of public health by the railroads in throwing up their embankments. It seems to me that, in considering this question, these forces for evil should be brought to terms in purging the State of malarial influences.

Mr. Coffey.— Mr. Chairman, we had a case somewhat similar to this, only of much smaller area, in Worcester, and caused, too, as Dr. Smith has said. The construction of a railroad embankment, I think, was largely the cause of the trouble there. In reference to what the Chairman has said about boards of health having ample authority to enter upon these lands and take the necessary steps for the abatement of the nuisance, the trouble is, as we found at Worcester, that you must have an appropriation; that is, the ordinary appropriations which are granted to health departments are not sufficient to pay for this work. It can be collected, to be sure, from the abutters and from the owners of the swampy, wet, rotten, and spongy lands; but in the mean time you must have an appropriation, in order that the work may be paid for as it is done. It may take some time, of course, to collect from those abutters. You can collect under the law, as you collect for delinquent taxes; but, if they should fight, it might drag along through the courts for several years. In the

mean time the people who do the work of course must be recompensed. In Worcester we did not have any appropriation; but we got after the railroad company, who owned this swampy land, and induced them to act by intimating, in the communication that we sent them, that, unless they did take some measures to abate the nuisance, we would enter the land. The statute was quoted for their benefit. The end was that we induced them to fill up the swamp and drain it. Another swamp that we had was down in the lower part of the city; that is, it was an old brook bed, called Middle River. It really was never a river. Vegetation had been allowed to grow up in it, and the vegetation had filled up the brook bed. The waters had spread over quite a large area, and the matter held in suspension was precipitated. Then at times of low water, in the hot and dry months of the summer, the sun poured down upon this precipitation that had more or less organic matter, and odors arose from it. Of late years we have been having considerable malaria in the vicinity of this brook, something that until recent years was comparatively unknown in Worcester. We sent a communication to the City Council; and we recommended that the waters of this brook be enclosed by walls, in that way preventing the spread of the water and confining it, so that of itself it would be self-cleansing. It was found by our law department that before we could do this it would be necessary to get permission from the legislature, and that was done at the last session. I think there is a bill coming up in reference to it again at this session. The City Council has voted to carry out our recommendation; and we hope that, when this is finished, we shall at least have less malaria than we now have.

Professor Sedgwick.—Mr. President, there is one other point that I think is worth raising, and that is this: Under existing laws, as I understand it, if Cambridge had refused to take any action, Belmont would have been helpless except by going to the legislature. Cambridge proved to be a good neighbor, and has done her part admirably. But it seems to me that cases are bound to arise in which neighbors may need a little prodding; and it seems to me also that the way things are going in our State, which is becoming more and more densely populated, and with our confidence in the higher sanitary authorities, the time is not very far distant when we are

going to delegate some more central powers to the State Board of Health, or some similar central authority, in order that they may deal with cases like this, so that it shall not be necessary for a town like Belmont, which finds its lands being overflowed by stoppages in the town below, over which it has no control, to go to the legislature to force the lower town to clean out its ditch. It seems to me that this point is worth raising and keeping in mind, because I believe that the State Board of Health ought to have distinctly more authority than it has to-day. While I should not go so far as to say that it ought to have all the powers that the Local Government Board has in England, I think we are moving in that direction, and rightly moving in that direction.

The Chairman.— Is there anything further to be said on this question?

Dr. Abbott.— Before we adjourn, I would like to say a word in regard to the typhoid fever work which the board has undertaken recently. Within the past week or two we have been called upon quite often by physicians in different parts of the State to examine specimens of blood with reference to the diagnosis of typhoid fever; and we have now made arrangements so that local boards of health can have the different means and appliances kept under their supervision, so that they can be sent directly to Dr. Smith. I have some of these here. Please to pass these around, that the members here can see what they are.

Mr. Coffey.— Mr. President, I had this proposed amendment to the constitution handed to me by Dr. Hill.

At any regular meeting of the Association names may be proposed for election as honorary members. Such names may be voted on at the same meeting, if approved by the Executive Committee, and, if elected, shall immediately become life members, without dues.

On motion of Dr. Abbott, seconded by Mr. Coffey, it was voted that this proposition be referred to the Executive Committee.

Mr. Coffey.— Now I should like to move that another matter be referred to the Executive Committee, and that is that some investigation be made by the Executive Committee on the question of estab-

lishing somewhere in Massachusetts a school for health officers. I understand this movement has started in other places, in some of the States. I understand Vermont has started something of this kind. I know the American Public Health Association has passed a vote recommending that something of this kind be done; and it seems to me that Massachusetts, with all the schools and colleges that we have here, should not be behind any of the other States in sanitary matters. Massachusetts has always been a leader; and it seems to me that this matter is a step in the right direction, that health officers might, if summer schools were established, obtain certain knowledge and information that would better qualify and fit them for the duties which they are to fulfil. I would move that the Executive Committee look up the matter, and make such recommendations as they may deem proper,—or make it a special committee, I am not particular.

THE CHAIRMAN.— If the mover of this question will allow me, I would venture to say that there are so few present, and it is a question of so much importance, that it might be better to permit the remarks now made to go before the Association in the *Journal*, and then be discussed and acted upon at the following meeting rather than to take a vote with so very few present.

MR. COFFEY.— All I desire is to bring it to the attention of the Association, so that it may be discussed or something done at the next meeting. That is my only object.

DR. HILL.— Would a motion be in order to have it referred now to the Executive Committee, so that they can consider it in the interval?

MR. COFFEY.— That is what I thought, that possibly they might consider it in the interval, and, if they saw fit at the next meeting, make a report on it, if they could; and, if not, they could let it go till the meeting following.

THE CHAIRMAN.— The chair will entertain the motion, if you prefer. It is moved and seconded that the question of establishing a school for the education of candidates for public health offices be referred to the Executive Committee.

The motion was adopted, and on motion of Mr. Coffey the meeting then adjourned.

Hyde Park.
Willard S. Everett, M.D.
Edwin C. Farwell.
William W. Scott.

Lancaster.
Allen G. Butterick.
H. M. Nash, M.D.
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Lawrence.
George S. Fuller, D.V.S.
F. W. Kennedy, M.D.
Fred H. Schaake, M.D.
George W. Smith.
Emil C. Stiegler.
J. F. Winchester, M.D.

Leominster.
C. E. Bigelow, M.D.
H. N. Spring.
A. L. Whitney.

Lexington.
George O. Whiting.

Lowell.
James Bayles.
William F. Curtin.
James B. Field, M.D.
J. Arthur Gage, M.D.
Thomas F. Harrington, M.D.
W. P. Lawler, M.D.
Thomas B. Smith, M.D.

Malden.
Frank H. Parker, M.D.

Marlboro.
F. F. McCarthy, M.D.
William S. Richardson, M.D.

Melrose.
Corydon W. Harlow, M.D.
J. E. Sanborn, M.D.

Milton.
Thomas K. Cummings.
H. P. Jaques, M.D.
Walter C. Kite, M.D.
Thomas N. Perkins.
C. Minot Weld.

Needham.
A. E. Miller, M.D.
A. M. Miller, M.D.

New Bedford.
D. C. Ashley, M.D.
J. T. Bullard, M.D.
Thomas W. Cook.
Edgar H. Gammons.
W. S. Kirschbaum.
Louis H. Richardson.
Manual V. Sylvia, M.D.
Edwin E. Waite, M.D.

Newton.
J. C. Brimblecom.
Francis G. Curtis, M.D.
George H. Ellis.
W. F. Harbach.
Arthur Hudson.
Henry A. Stone.
E. R. Utley, M.D.

New York City.
Col. W. F. Morse.

North Andover.
Charles P. Morrill, M.D.

North Brookfield.
T. J. Garrigan, M.D.

Norwood.
Eben C. Norton, M.D.

Pepperell.
C. A. Dennen.

Plymouth.
W. G. Brown, M.D.

Providence, R.I.
Ernest T. Badger.
C. V. Chapin, M.D.
F. P. Gorham, M.D.
Gardner T. Swarts, M.D.

Rockland.
Gilman Osgood, M.D.

Salem.
G. Arthur Bodwell.
Daniel Rollins Brown, M.D.
Charles B. Fowler.
W. H. Fullam.
W. H. Gove.
George G. Hathaway.
David M. Little.
George W. McIntire.
Raymond L. Newcomb.
George A. Newhall.
Chas. H. Phippen.
Jesse Robbins, M.D.
William O. Safford.
A. N. Sargent, M.D.
G. A. D. Stickney.
David P. Waters.

Somerville.
Robert Burns.
W. F. Holmes, M.D.
A. E. Merrill, M.D.
George Whiting.

South Framingham.
L. M. Palmer, M.D.
W. N. Sharp, M.D.

Springfield.
W. H. Chapin, M.D.
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Waltham.
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E. Irving Smith.
Charles A. Willis, M.D.

Watertown.
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Julian A. Mead, M.D.

Waverley.
L. B. Clark, M.D.

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C. E. Lovell, M.D.

Winchendon.
F. W. Russell, M.D.

Winthrop.
A. B. Dorman, M.D.
Horace J. Soule, M.D.

Woburn.
George Buchanan.
James H. Conway, M.D.
B. Frank Waldron.

Worcester.
F. H. Baker, M.D.
George E. Batchelder.
George W. Batchelder.
W. T. Clark, M.D.
James C. Coffey.
Prof. L. P. Kinnicutt.
J. F. McCartney.
L. F. Woodward, M.D.

THE JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH.

THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH was organized in Boston in March, 1890, with the following objects: the advancement of sanitary science in the Commonwealth of Massachusetts; the promotion of better organization and co-operation in the local Boards of Health; the uniform enforcement of sanitary laws and regulations; and the establishment of pleasant social relations among the members of the Association.

All persons holding appointments as members of a Board of Health in a Massachusetts city or town, the executive officers of such a local board, and the members of the State Board of Health are eligible to membership. Other persons may be elected members by vote of the Association. The annual dues are one dollar and fifty cents, and should be paid to the Treasurer, James B. Field, M.D., 329 Westford Street, Lowell, Mass.

The Association holds four regular meetings each year, the annual or January meeting always being held in Boston.

THE OFFICIAL JOURNAL OF THE ASSOCIATION is a quarterly publication, containing the papers read at the meetings, together with verbatim reports of the discussions following them.

All communications to the Association should be addressed to the Secretary, **EDWIN FARNHAM, M.D., City Hall, Cambridge, Mass.**

Subscriptions and all business communications should be sent directly to the publishers,

SMALL, MAYNARD & COMPANY,
Pierce Building, Copley Square, Boston.

JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH

April Meeting, 1901

SUBJECTS: Results Accomplished at Worcester Isolation Hospital — The Sewage Disposal Works at Worcester.

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JOURNAL OF THE

Massachusetts Association of Boards of Health.

ORGANIZED 1890.

[The Association as a body is not responsible for statements or opinions of any of its members.]

Vol. XI. July, 1901. No. 2.

APRIL MEETING

OF THE

Massachusetts Association of Boards of Health.

The quarterly meeting of the Association was held at the State Mutual Restaurant, Worcester, on the afternoon of April 25, 1901. In the absence of the President and Vice-Presidents the meeting was called to order by Dr. W. S. Everett, of Hyde Park.

The Chairman. — Gentlemen of the Massachusetts Association of Boards of Health, we are very fortunate this afternoon in having with us Mayor O'Connell, of Worcester. We shall be very pleased to hear him address us. Please give your attention to Mayor O'Connell.

ADDRESS BY MAYOR O'CONNELL OF WORCESTER.

Mr. Chairman and Gentlemen of the Massachusetts Association of Boards of Health, — I desire to express to you my appreciation of the compliment done me in inviting me to this dinner to-day, and for the added pleasure of meeting the members of this Association. It gives me great pleasure, on behalf of the city, to extend to you its freedom during your short stay among us.

I don't know that I have anything of particular moment to say to the members of this Association to-day. I am very glad that those

who have had charge of your trip here have seen fit to invite you to two of the most important features of Worcester's municipal life, so far as the health problem is concerned; that is, the isolation hospital and the sewage purification plant. I trust that your visit to the hospital has been a satisfactory one. I know that the hospital, as far as the city is concerned, has given the most satisfactory results. It, however, is an institution about which many of the people of Worcester know comparatively little. Even the members of the city government know little about the isolation hospital, because of the fact that they have no occasion to go there. It is not like the other hospitals, which are open and free to visitors; but most of us in Worcester are more or less hypochondriacs, and we are a little bit afraid of the isolation hospital. Still, we know enough of it to know that it is doing a grand good work among us,— a work that was much needed, and a work that is being appreciated more and more as its advantages are being brought to the knowledge of the citizens of Worcester. As one who is interested in the financiering of the problem, being at the present time the mayor of the city, and formerly having been a member of the Finance Committee of the City Council, it has been a matter of satisfaction to me to know that the institution has been economically managed, and is proving a success. I hope those of you who have not isolation hospitals in your own towns have derived some benefit from your experience there to-day. I think I can safely say, having been interested in the financial management of the institution, that, if you care to know how it is managed financially, we can give you a plenty of valuable information in that feature as well as in the practical management of the hospital.

The sewage purification plant, I understand, you are to visit this afternoon, if the time permits. I sincerely trust and hope that all of you who have the leisure may go there, because I believe you will find in it a very interesting problem. The city has, unfortunately, been compelled, very much against its will, to deal with the sewage question; but we do hope and believe that we are going to find a satisfactory solution of this great problem at our plant in Quinsigamond.

I have been rather interested in talking with the mayor of Lawrence to-day concerning some of the financial situations that confront

the city of Lawrence in regard to the sewage problem and the water problem, and I am rather sorry to learn that we are confronted in Worcester with very much more expensive problems than seems to confront the good city of Lawrence. It was a surprise to me to learn that my good friend, the mayor, is so confident that they have in Lawrence the best water in the Commonwealth. I supposed that we had pretty good water in Worcester, but the mayor assures me that it is not to be compared with the water that comes from the Merrimack River to the good city of Lawrence. Such, he assures me, is the fact, however, and he has promised to send me a sample, and for my own satisfaction has invited me to his city to inspect the filtration system, and also to taste the water.

In Worcester we have been obliged to roll up millions of indebtedness, in order to get an adequate supply of water. The water that we have is of excellent quality, but it has cost the city a great deal of money. Only last year we were obliged to borrow a million dollars to pay over to claimants along the Blackstone River, from Worcester to Providence. Every mill-owner on the stream came up here and demanded satisfaction and damages for a little bit of a tiny stream known as Kettle Brook, that winds its way down the Paxton Hillside. When you stop to think that that little stream has cost us a million dollars, and the city of Lawrence has the good fortune of that great river furnishing water without any expense, you can see something of the financial situation that confronts our city in this respect.

The same thing is true of our sewage purification plant. As I said in the beginning, very much against our will we were forced to tackle this problem of sewage purification; and we have already expended, I believe, something like a million and a half in the separating system and the purification plant. So that you see that Worcester, so far as these two great sanitary questions of water and the treatment of sewage are concerned, is confronted with very serious financial questions.

I don't know, gentlemen, that I have anything further that I would care to say to you, except again to express my pleasure at being with you, and also to commend you for the great interest that you evidently have in your Association. I did not expect, when I arose this morning and found the rain splashing as it has splashed down for

the last twenty-five days or more, that there would be very much of a delegation at this meeting to-day; but it evidently appears that you are not at all terrified by the rain, or perhaps you have not been having it elsewhere as we have had in Worcester. I want to say, in passing, that the mayor of the city is not responsible for the rain in Worcester. There are two gentlemen, however, who are here to-day, who are responsible, and directly responsible, for it. I mean the water registrar, who is a member of the Board of Health, and the city engineer. The city engineer and the water registrar and the water commissioner about a month ago were sorely troubled about the supply of water, and they used to come to my office daily, complaining of the serious situation that confronted us; and so the three of them got to praying, and they kept up praying for about two or three weeks, and this is the result. [Laughter.] I might say, in conclusion, that, if you are ever confronted in your home cities with any serious problems, such as a shortage of water, or the breaking out of cholera or typhoid fever or any other epidemic, you can call on our water registrar and city engineer and water commissioner; and I think they will be able to save you from any great danger. [Applause.]

The Chairman.—We are happy in having with us to-day Mayor Leonard, of Lawrence. We would be pleased to hear him address us.

Mayor Leonard, of Lawrence.— Mr. Chairman and gentlemen of the Massachusetts Association of Boards of Health, I cannot welcome you to Worcester, as Mayor O'Connell has; but I can thank you for the privileges accorded to me by the board of my own city, and also by the boards of all other cities, to be present at this little outing or annual inspection, whatever you may call it.

Of course, gentlemen, I am very pleased to meet the Massachusetts Association of Boards of Health. In the first place, I had a different impression, a different opinion altogether, about what constituted the Boards of Health, what kind of looking men they were. I have been reading some of the late inaugurals regarding the members of the Boards of Health; and I can assure you that I am very happily disappointed in meeting some of them — in fact, all of them — to-day,

including those from Salem. [Laughter.] I was more than surprised, gentlemen, in finding that the members could get along here to-day without their coachman that we have heard so much about. Consequently, I can not only compliment Salem on the intelligent appearance of its board, but every member present, I presume. I think every city that is represented here can be congratulated on its selection of members of the Board of Health.

Mayor O'Connell has told you, of course, that the water up in Lawrence is very good, etc.; and he has not told you anything but what is practically true, gentlemen. We take the water from the Merrimack River after Lowell and Manchester and Nashua and all other cities get good and through with it,— after they get through with everything they might see fit to do with or in it, etc. When they get good and through with it, we simply drink it, gentlemen, — after we get through bathing in it. Furthermore, I want to impress upon you the fact — and some time I would be very pleased to have the members of this board visit Lawrence, and prove to them and convince them of it — that there is not any city in the State that has any purer water than the city of Lawrence, notwithstanding the fact that we use it after all other cities on the line of the stream get through using it.

Now, gentlemen, you will please excuse me for interrupting your programme to-day. I did not intend to say a word. I am simply a passenger here. I am here as a matter of courtesy. I am brought here for a purpose. We have a Board of Health, gentlemen, of the city of Lawrence, — of course, you are aware of the fact that we have a Board of Health in the city of Lawrence, because they are here amongst you this afternoon,— and I am tired of hearing about this hospital and that hospital. Everything that is good the city of Lawrence has got. They kept impressing upon me the fact that the city of Worcester had a hospital, not only such as the city of Lawrence wanted, but something that the city of Lawrence wanted to improve upon; and we are not going to have a hospital equal to the one that you saw to-day, we are going to have a much better one. [Laughter.] It is very nice, gentlemen. As a matter of courtesy, I would like to be very complimentary to the mayor, and to the city of Worcester, etc., because they have used us very kindly; but I presume that I have got the same ambition that every member present has. Every one

that has not got a hospital of the kind and character that we visited to-day is very anxious and very desirous of having something of the kind. You all know the need and the necessity of such institutions. Consequently, it is not necessary for me to say a word on that question.

Nor is it necessary for me to say anything regarding your duties as members of the Board of Health. Up in the city of Lawrence we trust our affairs regarding health matters entirely to our board. We have an able and efficient board, and they are well able to take care of all matters of this kind. Consequently, for fear that I might make mistakes regarding matters that will concern you and upon which you will talk this afternoon, the safest way for me is simply not to refer to them at all. However, gentlemen, some time I hope to have the pleasure, following the example of the Mayor of Worcester, of extending to you a welcome in the city of Lawrence. We shall be glad to meet you there and glad to use you well. Before I retire, and without taking up any more of your time, I desire to thank you, one and all, for the courtesy you have shown to me and to the members from the city of Lawrence, and hope some day that we may be able to return it. [Applause.]

THE CHAIRMAN.— We will now listen to the reading of the records of the last meeting by the Secretary.

On motion of Dr. H. W. Hill the records were taken as read.

THE CHAIRMAN.— The Executive Committee have reported for membership in this society the following names: Fred R. Houghton, of Fitchburg, a member of the Board of Health; Dr. A. O. Hitchcock, of Fitchburg; Dr. Charles F. Stack, of Hyde Park; Dr. Charles R. Marble, of Hingham; and Charles Sedgwick Minot, of Milton.

The gentlemen named were elected to membership in the Association.

The next business to come before you will be the reading of the paper on "Results Accomplished at the Worcester Isolation Hospital," by Dr. May S. Holmes, superintendent and resident physician.

RESULTS ACCOMPLISHED AT WORCESTER ISOLATION HOSPITAL.

BY DR. MAY SALONA HOLMES, SUPERINTENDENT AND RESIDENT PHYSICIAN.

It is unfortunate that certain infectious diseases are the unwelcome but ever-present guests of all organized communities to-day. Therefore, it has become the duty of the board of health of these communities to provide for their isolation. If there could be thorough co-operation of the citizens with the boards of health to this end, no doubt these diseases could be wiped out of existence in a comparatively short time. It is needless to say, however, that we cannot hope for this happy result until the millennium comes; for it is inevitable that many mild and atypical cases will not be recognized, that many will be wilfully concealed, and that, owing to the popular prejudice to hospitals of this kind, commonly called pest-houses, many more will refuse the isolation provided. There has been in recent years considerable progress made by the municipal control of infectious diseases, which must inevitably have had its effect upon their spread. Owing to this recognition of the constant menace to life from disease in its cities, the Massachusetts legislature in June, 1894, passed the following act: —

Section 1. In any city in which no suitable hospital accommodations have been provided for the care and treatment of persons suffering from contagious diseases dangerous to the public health, the board of health of such city may address a communication to the mayor thereof, stating that, in the opinion of said board, the safety of the inhabitants of the city demands that suitable hospital accommodations should be provided for the reception and treatment of persons suffering from such diseases other than small-pox and those of a venereal nature. The mayor shall forthwith transmit such communication to the city council; and the city council shall forthwith order such hospital accommodations to be provided, and shall make the necessary appropriations therefor.

Sect. 2. Every city in which hospital accommodations have been

provided in accordance with the provisions of this act shall make an annual appropriation for the maintenance of such hospital accommodations; and said appropriations shall be expended under the direction of the board of health unless otherwise ordered by the city government.

In accordance with this act the Board of Health of Worcester sent to the Mayor of this city in January, 1895, a request that early provision be made for such a hospital. An appropriation of $30,000 was accordingly set aside, the plans submitted, and the erection of the hospital begun that same year. The site obtained for the hospital was a most fortunate one. Few cities are able to furnish a location so admirable in such a variety of ways. The distance from the centre of the city is not great; and yet it is practically in the country, with an apple orchard in front and woods in the rear. There is plenty of land to cultivate for garden supplies. The patients have playground space a sufficiently safe distance from neighbors. The buildings are on the slope of a hill of good elevation with a southern exposure. Sunlight and the circulation of fresh air are unobstructed. The plans of the buildings were made by Fuller, Delano & Frost of this city. There are four separate buildings arranged in a hollow square. The appropriation did not permit of making preparation for but two diseases. Scarlet fever and diphtheria were, therefore, selected as the two most common and most malignant of the infectious diseases, and hence the greatest menace to the welfare of the city.

There has been really great demand made upon us to isolate measles also; but the city government has not been able as yet to add to our appropriation a sufficient amount for that purpose.

The hospital, as at first erected, consists of an administration building. Forty feet to each side of this and somewhat to the rear are the ward buildings, the one on the east for diphtheria, and the one on the west for scarlet fever. These three buildings are connected by both over and under ground corridors. In the rear is a separate building, in which are the ward laundry, the sterilizing plant, a morgue, and chapel. The wards are exactly alike in plan. Each provides 2 rooms which can accommodate from 12 to 16 patients, 3 private rooms, and a nurse's serving kitchen. There are closets

and bath-rooms at the extreme ends of each ward building, separated from them by cross corridors for ventilation.

With 6 beds in each ward, 80 cubic feet of fresh air per patient per minute is provided. The heating is by indirect radiation. In addition there are windows on opposite sides of the wards for cross ventilation, and there are fireplaces. 15 patients can thus be comfortably cared for in each building. A few more even may be easily added, provided they will accommodate us in their division as to age, sex, and degree of sickness. For the past year the average number daily in the hospital has been 25, to be divided between the 2 diseases. Our largest number at any one time was 45, 31 of whom had to be stowed away in the scarlet fever building. That was not comfortable, however. The basements are cemented throughout. Robing-rooms are provided in them, where nurses change their outer clothing on entering and leaving the wards, and where the attending physicians and necessary visitors don robes and caps. The work of the hospital increased so rapidly that the administration building has already had to be remodelled and enlarged to provide for more nurses and for their better accommodation. More cold storage room and a larger heating plant were also added. We have also bought an adjoining cottage with additional land at a cost of $3,500. The cottage enables us to provide for our janitor's family, and to separate the nurses in the scarlet fever wards from those in the diphtheria. We had never been able in any way to suspect any mixing of infection by the intermingling of our nurses; but, as the hospital grew, the danger increased, and we were much pleased when we were able to separate them. We have not yet been able to trace a case of infection to any of the employees. Although the buildings are so thoroughly separate in their entire equipment, the patients themselves are not always accommodating, but will persist occasionally in having more than one infectious disease at the same time. To place such patients where they will do no harm to others taxes our equipment exceedingly, especially in the winter months when we are crowded. We do feel a very urgent need for a separate building for mixed infections, and hope that its realization is not far distant. Otherwise the plan of the hospital has proved to be very practical and, in the main, satisfactory. This separate cottage plan is one

we would always heartily recommend. The entire cost of the hospital plant, including seven acres of land, and the additions has been $50,000. The average net cost per year for maintenance has been $6,849.

As the work of the hospital has increased, the administrative force has grown in proportion until now it consists of a superintendent and resident physician, a housekeeper and a superintendent of nurses. There is an attending staff of four physicians and a pathologist. The entire question of obtaining nurses has throughout been a serious one. We hope, however, that our latest plan, even though a bold one, of instituting our own training school, will solve the problem. At first we depended upon the City Hospital, and a course in contagious diseases was made a part of the curriculum of their school. It became impossible for them, as time went on, to furnish a sufficient number; and we were obliged to hire nurses from other sources. The supply available was limited, however; and we were frequently at a loss to obtain enough who were sufficiently capable to carry on the work satisfactorily. We were therefore driven to the last resource of training our own nurses, and have so far been encouraged in our undertaking by the results. We expect to supplement the course in our own hospital by work elsewhere in surgery and obstetrics before awarding any diploma. We are also able to continue the training of the City Hospital nurses and to admit a limited number of post-graduates from out-of-town hospitals for a four months' course. The number of these applicants is steadily increasing as the hospital becomes better known. The fear of contracting the diseases has had its influence more or less upon the peace of mind of the nurses. A certain proportion, perhaps half, have been immunized with diphtheria antitoxin. No one of these contracted the disease under six weeks' time. The rashes have been rather disagreeable in some cases, and we have therefore ceased to urge immunization. Should a nurse contract the disease, we have no fear of being unable to control it with the help of antitoxin. Since the opening of the hospital, ninety-seven different nurses have been employed. Of this number, four contracted diphtheria, four scarlet fever, and one whooping-cough. This makes the percentage for each of the two diseases 4.12 per cent. of the number employed, and for all diseases 9.2 per

cent. No other employees in any capacity have contracted disease with the exception of the superintendent, who had each in turn, and one member of the staff, who contracted diphtheria. Even ward maids and laundry girls have so far been exempt.

Owing to the limited capacity of the hospital, the administration has been obliged to make rather rigid rules for the admission of patients, especially on the diphtheria side. No case of diphtheria is admitted until the bacteriological report supports the diagnosis, except in laryngeal cases. This rule has not always been approved by the profession; but we have felt that, taking into consideration our limited capacity, it was best, for all concerned, to adhere to it. With the help of antitoxin there are few cases which cannot wait the few hours necessary for the report, which at most is only twenty-four and, in cases of special urgency, can be reduced to six. The swab even can be examined at once, under certain conditions. The repeated admission of patients suffering from tonsillitis of non-dipththeritic origin can be thus avoided. We have no place to separate them from the diphtheria patients; and, even though anti-toxin renders them immune, they have to submit to the sterilization of their clothing and to the other disagreeable features necessarily attending isolation. Antitoxin has been most generously supplied by the State Board of Health, and is kept constantly on hand for distribution by the local board. The hospital has also had the benefit of this generosity on the part of the State Board, and we wish to publicly express our gratitude to them for it. We feel sure that by its unstinted use we have not only saved lives, but have been able to swell the statistical records in its behalf. Diphtheria patients are not discharged until two consecutive negative cultures have been obtained. We do not possess the same degree of scientific knowledge about the infectious period of scarlet fever, but no patient is discharged until the skin is absolutely smooth. No visitors are admitted to see the patients, except where there are indications of a fatal termination of the disease. Then only the adult members of the immediate family are admitted, together with the spiritual adviser and such others as are absolutely necessary. Professional courtesy is always shown physicians.

As to our sterilizing plant: — the steam sterilizer which was made

for us by the Stewart Boiler Works has been very satisfactory. It consists of a jacketed cylinder large enough to admit mattresses. A brick partition crosses it in the middle, so that the infected material can be put in at one end and taken out of the other. By never opening both ends at the same time there is no communication between the infected and clean rooms. All materials that can be disinfected by the ordinary boiling in the laundry are done in that way. Blankets, mattresses and, until recently, the patients' clothing were disinfected by the steam. We now use formaldehyde, when practicable. Steam under pressure necessarily affects the materials submitted to it to a certain extent. Cloth will shrink, stains will be set, and the peculiar odor of heated wool will be left. Our sterilizer is a good one, however; and we think these disadvantages are reduced to a minimum.

The hospital opened to admit patients Nov. 25, 1896; and from that date until the end of the year 11 patients were admitted. 7 of them had diphtheria, 2 had scarlet fever, and 2 did not have either disease. In spite of our vigilance, patients occasionally get in who do not have either diphtheria or scarlet fever. Eruptions are often thought to be those of scarlet fever which later prove to be due to some other cause, and sometimes patients are unceremoniously dropped at our doors who do not belong there. In 1897 there were 92 patients. That was our first complete year. In 1898 there were 99 patients; in 1899, 203; and, in 1900, 338. During the first year, 1897, there were 70 cases of diphtheria treated, which was 20.8 per cent. of the cases reported in the city. The next year 23.9 per cent. came in. In 1899, 29.7 per cent. entered, and in 1900 38.3 per cent. Of scarlet fever cases the first year we received 7 per cent.; of the cases in 1898, 9.7 per cent.; in 1899, 17.7 per cent.; and, in 1900, 27.2 per cent.

You will observe from these figures that not only have the actual numbers treated at the hospital increased year by year, but the proportion of cases has increased also. In this city, as well as elsewhere, the mortality rate for diphtheria has been decreasing in recent years. This is due principally to the routine bacteriological examination of all sore throats, to the increasing popularity of antitoxin among physicians in private practice, and to the hospital. There

were 6 deaths from diphtheria the first year in the hospital, making the mortality rate 8.57; while the death-rate for the city that year was 17.62. Excluding the cases treated at the hospital, the rate was 20.24. Therefore, the hospital lowered the city's mortality by 2.62. In the same way we find that the city's rate was lowered in 1898 by .85; in 1899, by 1.17; and, in 1900, by .77,— and that, too, in spite of the fact that most of the septic cases came to the hospital, as well as a large proportion of those requiring operation.

Since the opening there have been 479 cases of diphtheria treated, with 38 deaths, giving a mortality rate for the whole time of 7.93. The same good results were obtained, also, on the scarlet fever side. During the first two years there were no deaths from scarlet fever in the hospital. I would say here that the Board of Health has never yet compelled a case to enter the hospital. The hospital treatment is rather offered to them as a privilege; and their acceptance has been purely voluntary, as far as the board has been concerned. Limited capacity has been one cause for this stand. Also, it was thought that the hospital would gain more patients in the end, would obtain the public confidence by its good reputation, and that the idea of it being a pest-house, where all sorts of horrible, loathsome diseases are supposed to be huddled together, would gradually disappear. You can infer from the figures how successful this has been. The benefits derived from such a hospital are far greater, however, than are shown by simple mortality statistics. In fact, the most important ones are negative in visible results. By the complete isolation afforded these cases of infectious diseases there is no question but that epidemics have been aborted.

There are in Worcester, besides the public schools, many private institutions where large numbers of young adults are brought into close contact. There have been in the past four years repeated outbreaks of infectious diseases in these places. These have occurred especially in the private schools. Scarcely one has escaped, but by the immediate removal to the hospital of the cases as they appeared the spreading of the disease was prevented. Not one of the institutions had to be closed. The appearance of these outbreaks in schools is acknowledged to be inevitable, but the facility offered by the city for the control of the same is sure to be appreciated by the

patrons of these schools. Therefore, their reputation is enhanced and indirectly that of the city, also. Then, too, there are adults constantly being admitted from the boarding-houses and hotels, from factories and stores. Servants in private families are not exempt. By these the privileges of the hospital are even still more appreciated. Another important step gained by such a hospital is the advance which can be made by the properly directed study of these diseases in a suitable environment. The actual value of any particular method of treatment can be better determined in a hospital where the patients are constantly watched by trained observers, and where the officious interference of well-meaning friends and the other ill-effects of home environment can be eliminated. Physicians, therefore, look to the hospitals for practical results of scientific research and discovery. The wide-spread use of antitoxin to-day is a striking example, and this hospital has done its share toward proving its life-saving powers.

Such, then, is the Isolation Hospital,— its administration and the results as we are able to judge of them at the end of four years. We feel that the city government has the right to consider its money well appropriated, and that we can heartily encourage other cities, which have not already established such a hospital, to follow our example.

The Chairman.— The next business before the meeting will be a note on "Apparent Diphtheria Infection from Well Persons Carrying Diphtheria Bacilli," by Dr. F. W. White, of Boston.

Dr. Hill.— Dr. White is not present, and has asked me to read his paper; but on account of the short time that we have I think just to read it by title will be sufficient, if you are willing.

The Chairman.— We shall understand that we are to have it at another meeting?

Dr. Hill.— Yes, sir.

The Chairman.— The next thing in order will be the reading of a paper entitled "Description of Sewage Plant and Methods of Sewage Purification used at Worcester," by Professor L. P. Kinnicutt, of the Worcester Polytechnic Institute.

THE SEWAGE DISPOSAL WORKS AT WORCESTER, MASSACHUSETTS.

WITH A BRIEF NOTICE OF CERTAIN EXPERIMENTS MADE BY HARRISON P. EDDY AND LEONARD P. KINNICUTT.

Mr. President and Gentlemen,— On October 15, 1890, a little over ten years ago, I had the pleasure of addressing this Association at a meeting in this city, taking as my subject "Sewage and Sewage Disposal," with a description of the Worcester Sewage Plant. To-day I again have the pleasure of addressing the Association at its meeting in this city, and take the liberty to again address you on the same subject, giving, also, a very brief outline of certain experiments which have been made by Mr. Eddy and myself on the action of septic tanks on Worcester sewage.

In my talk to you ten years ago I described quite fully the three processes that at that time had been tried successfully on a large scale; namely, sewage farming or broad irrigation, chemical precipitation, and intermittent downward filtration. The last of these methods was then in a more or less experimental stage; but the statements that I made at that time — namely: "This method has received most careful consideration from sanitary engineers; and it is with this method that extended experiments have been made by the Massachusetts State Board of Health at Lawrence. Their report on the subject is now in press; and, therefore, the time has not come to discuss it at any length. From what I know of the work, I believe their experiments will show that domestic sewage — sewage that does not contain refuse from manufactories — can be sufficiently purified so as to enter a river not used as a water supply, by intermittent downward filtration through carefully prepared beds of sand"— have been more than justified, and the modern methods of sewage purification are bacterial methods; and that this is the case is due, to a very great extent, to the excellent work of the Massachusetts State Board of Health.

Regarding the other two methods that I then mentioned, sewage

farming and chemical treatment, what I said regarding the first, sewage farming, I still believe to be true: "that this method of purification cannot be recommended, except in very rare cases, on account of the character and the amount of land required."

What I said, however, in regard to chemical precipitation has not stood so well the test of time as my other statements; and I would not to-day state that chemical treatment as then understood is the most satisfactory way for the purification of sewage containing large amounts of free acid and mineral waste. Yet, after ten years of study of this question, and a rather intimate knowledge of what has been attempted both in America and Europe, I am not able to-day to say to the authorities of a city whose sewage is of a decided acid character that there is any method which, at an allowable cost, will surely give satisfactory results.

As I said a moment ago, the modern methods of sewage treatment are all bacterial,— that is, depending on the action of micro-organisms for breaking up and decomposing the putrefiable matter in the sewage; and the question that is at the present time receiving the most consideration from sanitary engineers is how to provide the most favorable condition for the action of these micro-organisms. It is now known that the decomposition of the animal and vegetable matter in sewage takes place in two stages, known as the putrefactive and nitrifactive stages. The first is brought about by bacteria that live in the absence of air, the anærobic bacteria. They break up the more complex substances, and bring them into a condition where bacteria which must have air to exist, the ærobic bacteria, decompose them into harmless gases,— hydrogen, marsh gas, nitrogen, ammonia, carbon dioxide,— and cause the oxygen in the air to unite with part of the nitrogen to form mineral substances known as nitrates. The more modern methods try to bring about conditions which will admit of these two processes taking place separately, and have devised tanks known as septic tanks, or resolving chambers, in which the first action takes place, and double contact beds, in the first of which beds the action, to a greater or less extent, is the putrefactive or anærobic action, and in the second the nitrifying; and we now, besides the intermittent filtration process, talk about the septic tank treatment and the double or triple contact system.

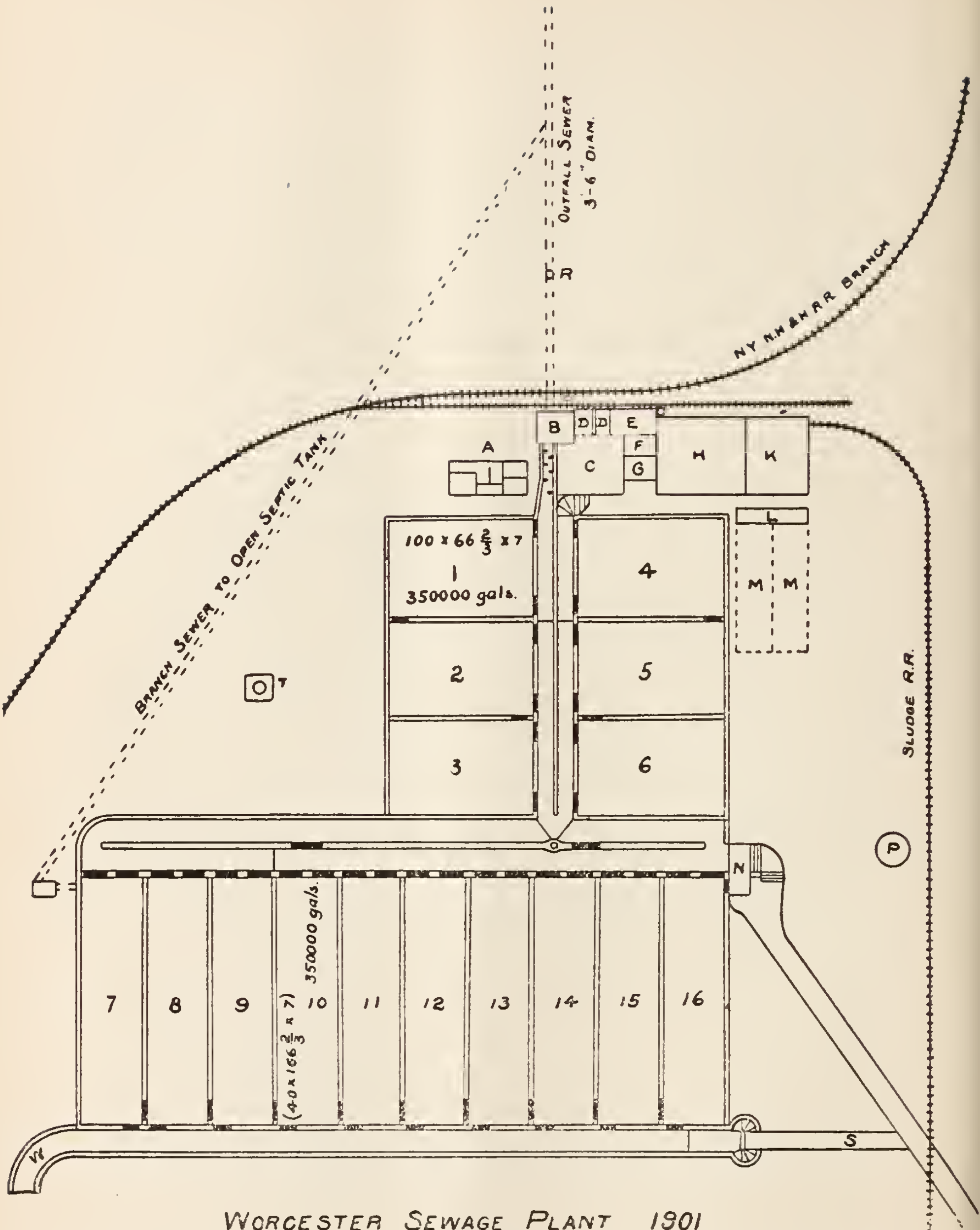
The septic tank process I described to you at the meeting held in Boston last July, and to-day I can show you in operation a rather large open septic tank and a small experimental closed tank. At this time I will only say that the septic tank treatment is a preliminary treatment,— a treatment which does not, by any means, purify the sewage, but a treatment which takes out a large amount of solid matter and renders the sewage more easily acted upon by the bacteria that live in the presence of air; in other words, prepares the sewage for treatment by intermittent filtration or by the contact system.

The contact method of treatment is a device to bring about on a small area the same results as those brought about by intermittent filtration on a much larger area. It differs from the intermittent filtration in using entirely artificially made beds filled with a rather coarse, hard, granular material, and filling the bed with sewage, allowing it to remain full a certain number of hours and then quickly drawing off the purified sewage; while in the intermittent filtration method the sewage is allowed to filter slowly through a natural but underdrained bed of sand a certain number of hours each day. The results obtained by the contact method are not as good as those obtained by intermittent filtration; but the method, when properly managed, gives a product which is not putrescible and, consequently, does not cause a nuisance when allowed to enter a small watercourse.

Having thus briefly given an outline of the methods of sewage treatment, I will devote the remainder of the time to outlining the work that is being done and the experiments that are being made at the Worcester Sewage Disposal Station.

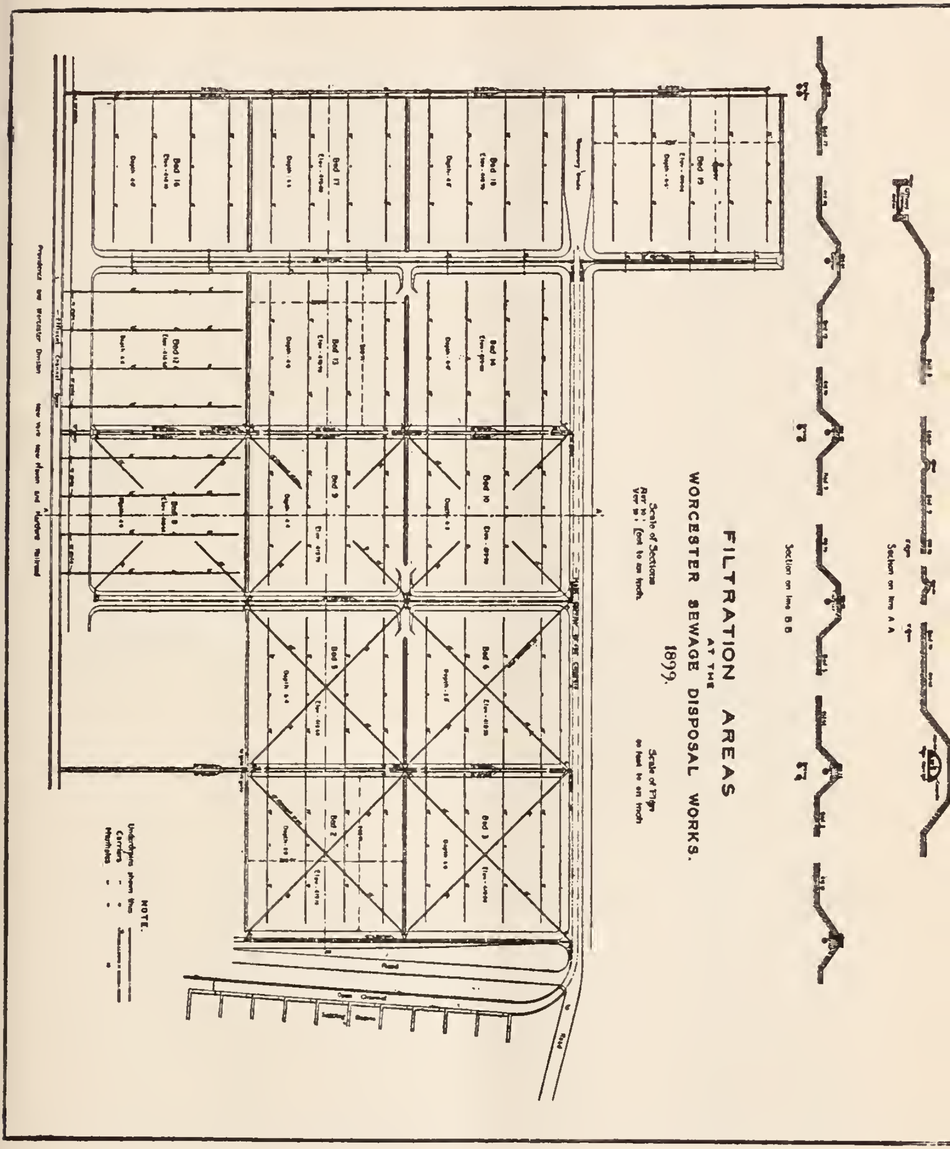
Worcester sewage, as it comes to the plant, is a sewage containing free acid, iron salts, wool washings, tannery waste, dyestuffs, etc., besides the substances ordinarily found in the sewage of a residential town. When it reaches the works, it is made alkaline by the addition of lime, about 7 grains of quick-lime now being added, on the average, to a gallon of the sewage. The amount added varies greatly. With sewage which contains a large amount of tannery waste and dyestuffs, much less lime being used than with sewage that is less colored and containing more free acid and iron salts.

Diagrams 1 and 2 give the ground plan of the disposal works, and I will make use of them in describing the methods used.



WORCESTER SEWAGE PLANT 1901

DIAGRAM I



WORCESTER SEWAGE PLANT

DIAGRAM 2

When the sewage contains tannery refuse, which is about seven hours each day, the lime is run from the lime-house back to point R, where it enters the sewer. The sewage containing the lime runs down the channel, and is divided into two portions, one-half running into tanks 2 and 3, the other half into tanks 4, 5, and 6. The sewage is then united again into one portion, and half goes through tank 8 and half goes through tank 9, and then on to the filter beds, thirteen in all, filter bed 8 being reserved for the effluent from the open septic tank. From the filter beds the effluent runs into the Blackstone River. The amount of lime added equals about 4 grains per gallon.

The filter beds are of an acre superficial area, and each bed receives 500,000 gallons every other day.

When the sewage is comparatively free from tannery waste, after receiving the lime, 9 grains per gallon, it is carried down the channel to basins 10 to 16, each basin receiving an equal amount. The effluent from these basins runs directly into the river.

As to the filter beds, diagram 2 shows their general construction.

Diagram 3 gives a section and ground plan of four of the sixteen intermittent filtration beds of the sewage plant at Worcester, Mass., and also a diagram showing the valves controlling the flow in the feed pipes and in the drains.

The beds are of coarse sand, from which all pockets of clay and quicksand have been removed. They are each of about one acre superficial area, and are divided from each other by dikes, those containing the feed and drain pipes being raised six feet above the level of the beds, while those running at right angles to these are only eighteen inches high. In order that certain of these beds should be fairly water-tight, the dikes surrounding them are lined with tamped clay. The drains of Akron pipe, laid with open joints, are six feet below the surface of the bed, and are fifty feet apart, the outer ones being twenty-five feet from the edge of the bed. The first hundred feet of pipe in each bed is 10-inch pipe, the remainder is 8-inch. The drains connect with two 24-inch pipes, placed in the dikes between the beds; and by the aid of valves the drainage of each bed can be separately collected, in order that the exact action of the bed can be tested.

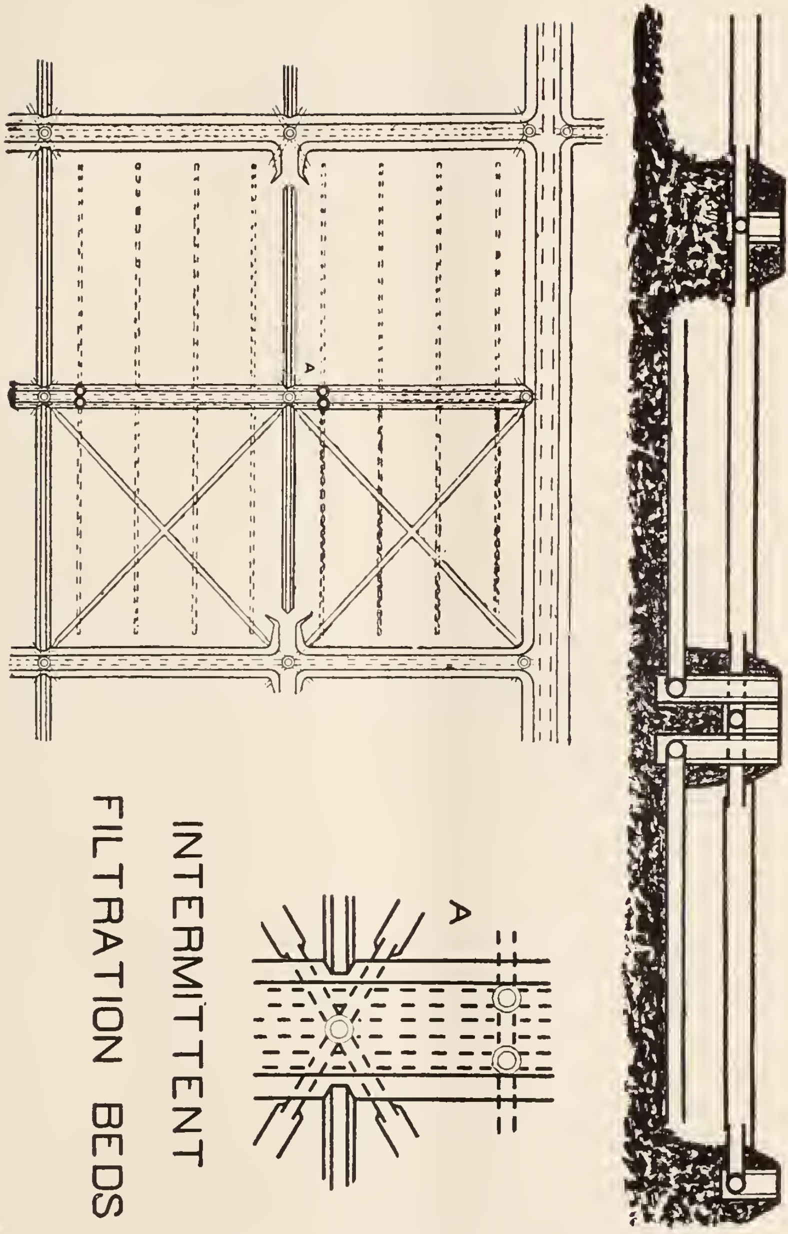


Diagram 3

The feed pipes are eight inches in diameter and are connected with split pipes, which in four of the beds extend across the entire distance of the bed, in order to give an even flow over the whole surface of the bed; and the flow upon the bed is regulated by molasses gates placed in the manholes at the four corners of each bed.

The following table shows what has been accomplished at the Worcester Sewage Plant during the past year by the chemical precipitation process. The results are averages of daily analyses: —

FOR THE YEAR 1900.

	Ammonia.				Oxygen Consumed.	
	Free.	*Albuminoid.*				
		Total.	*Dissolved.*	*Suspended.*	*Total.*	*Filtered.*
Sewage	1.097	0.480	0.237	0.243	5.63	3.24
Effluent	0.988	0.222	0.211	0.011	2.71	2.71
Per cent. removed	9.93	53.73	10.97	95.53	51.73	16.36

Judging from the albuminoid, ammonia, and oxygen consumed, a purification of a little over 50 per cent. has taken place. This result is as good as can be obtained by the chemical treatment of a sewage, that process doing very little more than removing the suspended putrescible substances.

As to the purification of the effluent from the chemical precipitation process by the intermittent filtration beds, the albuminoid ammonia is reduced to 0.07 parts in 100,000 parts, and the amount of nitrogen as nitrates formed equals about 0.75 parts in 100,000.

The disposal of the sludge, the insoluble matter thrown down by the chemicals used, is the most difficult problem connected with the process of chemical treatment. The idea that it will be bought or taken as a gift to any extent by farmers has at last been abandoned. At Worcester it is treated as follows: From the tanks it flows by gravity to a well at the point P, diagram 1, from which it is raised by an ejector to the sludge tanks MM., passed into the screen house L, and, after being mixed with lime, is pumped into the presses. The expressed liquor is carried to a special filter bed, not shown on the plan. The pressed cakes are dropped into open cars and carried by the sludge trolley railroad about a mile below the works, and dumped into a deep valley, which in this way is being gradually filled up.

About 5,000 gallons of sludge, containing 93 per cent. water, is

formed from each million gallons of sewage treated; and about 20 pounds of lime are added to each 1,000 gallons of this sludge before it is pressed. After pressing, the sludge contains from 70 to 75 per cent. water; and the amount equals about 6 tons for every million gallons of sewage treated. The sludge, dried at 100 degrees Centigrade, contains 40 per cent. of organic or volatile matter.

During the past year Mr. Harrison P. Eddy, the superintendent of sewers, and I have been studying the action of septic tanks on acid, iron sewage; and, though we are not as yet prepared to publish the results, the following notes may be of interest: —

Tank No. 7, diagram 1, holding 350,000 gallons, has, since the first of last June, been used as an open septic tank. The flow through this tank has been regulated so that 300,000 gallons of crude sewage, taken, as shown on the plan, from a point above where the lime is added to the sewage, flow through this tank in 24 hours; and from July 1, 1900, to April 1, 1901, about 82 million gallons of sewage have passed through the tank. One month after the sewage had passed through the tank a scum began to form, which increased in thickness until it was about ½ inch thick. During a violent windstorm in September this coating was blown off the tank, and has never re-formed; but action has gone on in the tank, as shown by the gas being continually given off, and by the analyses of the gas and of the liquid as it passes from the tank.

The formation of a thick coating on top of the liquid in a septic tank seems to depend somewhat on the character of the sewage. At Leeds, Manchester, Huddesfield, the open septic tanks are covered with a thick crust; while, according to Mr. Cairns (Report of Sewerage Commission of Connecticut, 1901, page 49), at Birmingham there is no crust or thick scum on the surface of the liquid.

The action of the septic process on Worcester sewage is shown by the following results, which are the averages of analyses of daily samples from July 1, 1900, to April 1, 1901: —

		Ammonia		*Oxygen*
	Total solids.	*Free.*	*Albuminoid.*	*Consumed.*
Crude sewage	75	1.726	0.690	9.04
Effluent from tank . . .	50	2.229	0.496	7.05

33 per cent. of the total solid matter has been removed, equalling

25 parts in 100,000 parts, or 14.64 grains per gallon. The total solid matter removed from the sewage during the nine months is therefore 82 million times 14.64 grains, or 85 tons.

The bottom of the tank has never been cleaned out, and from measurements made last Tuesday the average depth of the sludge, or deposit, at the bottom of the tank seems to be about 10 inches, which makes a deposit equalling 5,533 cubic feet. One cubic foot of this deposit contains about 5 pounds of solid matter. 5,533 cubic feet would therefore contain about 14 tons. Deducting this amount from 85 tons, we have over 70 tons of solid matter that has been liquefied or changed into gases.

The amount of purification that has been brought about by the septic action (judged from the albuminoid ammonia) is 29.1 per cent.

The results obtained with Worcester sewage by septic action in an open tank are not as satisfactory as have been obtained in the great majority of cases where the septic process has been tried; and this can be explained, I believe, by the acid iron character of the sewage, the amount of iron sulphate and free acid each equalling about 10 parts in 100,000 parts.

The effluent from the open septic tank has been run on to bed 8, diagram 2; but I cannot at this time give exact figures showing the amount of purification that has been brought about by the bacteria in this bed, but can say that, though there has been very little nitrification, the albuminoid ammonia has been reduced, so that the effluent from the bed contains only 0.1 part albuminoid ammonia in 100,000.

Very careful experiments have also been made by Mr. Eddy and me on the action of a closed septic tank on acid iron sewage, the results of which we hope soon to publish. The general action of the tank has been similar to that of the open tank.

One result, which I believe is new, I can mention at this time; and that is regarding the change that takes place with the iron sulphate in the sewage. The iron sulphate is reduced to iron sulphide; and the iron sulphide thus formed is in a very fine state of subdivision, so that a comparatively large amount is carried off in the effluent. It is due to this fact that the effluent is of so dark a color, and that a greater amount of solid matter is not removed by the septic action in iron acid sewage.

When this insoluble iron sulphide which is in the effluent is allowed to settle and is dried at the temperature of the air, it is changed into ferric oxide and free sulphur. This is what might be expected, as it is the change that takes place with pure iron sulphide; yet, as far as I know, it has never been noted in experiments on sewage purification. What effect free sulphur has on the bacteria contained in the sand filters is a question we are now studying.

There is only one other result that I will mention at this time, and that is regarding the gases given off from the septic tank. The amount varied very greatly. In October it was about $3\frac{9}{10}$ cubic feet for every 1,000 gallons treated, while the amount during December did not average over $1\frac{3}{10}$ cubic feet per 1,000 gallons. The gas had a decided odor, but did not contain sulphide of hydrogen, and was a mixture of carbon dioxide, marsh gas, nitrogen, oxygen, containing only in comparatively few cases any amount of hydrogen. The gas seemed also to contain small quantities of another substance, varying from 0.1 to 0.6 per cent.; and this substance, in certain analyses of septic tank gases that have recently been published, is stated to be carbon monoxide. (Thirty-first Annual Report, State Board of Health of Massachusetts, page 422.) In over two hundred analyses we have made of the gases given off from the septic tank, we have obtained, in the great majority of cases, small amounts of this substance; but we feel quite positive in stating that it is not carbon monoxide, for, while it is absorbed by cuprous chloride, it gives neither the hæmoglobin nor the iodine pentaoxide reaction. We hope later to be able to show what the substance is.

I have already occupied too much of your time, and must defer giving any more details regarding the experiments that have been made, which, however, will be published in full in the near future. I only hope that I have at this time given you a sufficient idea of what is being done at the Worcester Sewage Disposal Plant to make your inspection of the works one of some interest.

THE CHAIRMAN.— Owing to the lateness of the hour, it seems desirable that discussion of these papers should be postponed until another meeting of the society.

MR. SCOTT.— Mr. Chairman, I move that a vote of thanks be extended to the speakers of the day.

The motion was adopted, and the Association then adjourned.

(*Continued from page ii.*)

Hyde Park.
Willard S. Everett, M.D.
Edwin C. Farwell.
William W. Scott.

Lancaster.
Allen G. Butterick.
H. M. Nash, M.D.
F. A. Willard.

Lawrence.
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F. W. Kennedy, M.D.
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Leominster.
C. E. Bigelow, M.D.
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Thomas N. Perkins.
C. Minot Weld.

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A. M. Miller, M.D.

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J. T. Bullard, M.D.
Thomas W. Cook.
Edgar H. Gammons.
W. S. Kirschbaum.
Louis H. Richardson.
Manual V. Sylvia, M.D.
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J. C. Brimblecom.
Francis G. Curtis, M.D.
George H. Ellis.
W. F. Harbach.
Arthur Hudson.
Henry A. Stone.
E. R. Utley, M.D.

New York City.
Col. W. F. Morse.

North Andover.
Charles P. Morrill, M.D.

North Brookfield.
T. J. Garrigan, M.D.

Norwood.
Eben C. Norton, M.D.

Pepperell.
C. A. Dennen.

Plymouth.
W. G. Brown, M.D.

Providence, R.I.
Ernest T. Badger.
C. V. Chapin, M.D.
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James C. Coffey.
Prof. L. P. Kinnicutt.
J. F. McCartney.
L. F. Woodward, M.D.

JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH

July Meeting, 1901

SUBJECTS: Diphtheria Bacilli in Well Persons (Cleanliness among School Children) — Diphtherial Infection from Well Persons — Survival of Typhoid Bacilli in Cooked Shell Fish — The Etiology of Malaria with Special Reference to the Mosquito as an Intermediate Host

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F. F. Wesbrook, M.D., Honorary Member.

THE JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH.

THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH was organized in Boston in March, 1890, with the following objects: the advancement of sanitary science in the Commonwealth of Massachusetts; the promotion of better organization and co-operation in the local Boards of Health; the uniform enforcement of sanitary laws and regulations; and the establishment of pleasant social relations among the members of the Association.

All persons holding appointments as members of a Board of Health in a Massachusetts city or town, the executive officers of such a local board, and the members of the State Board of Health are eligible to membership. Other persons may be elected members by vote of the Association. The annual dues are one dollar and fifty cents, and should be paid to the Treasurer, James B. Field, M.D., 329 Westford Street, Lowell, Mass.

The Association holds four regular meetings each year, the annual or January meeting always being held in Boston.

THE OFFICIAL JOURNAL OF THE ASSOCIATION is a quarterly publication, containing the papers read at the meetings, together with verbatim reports of the discussions following them.

All communications to the Association should be addressed to the Secretary, **EDWIN FARNHAM, M.D., City Hall, Cambridge, Mass.**

Subscriptions and all business communications should be sent directly to the publishers,

SMALL, MAYNARD & COMPANY,
Pierce Building, Copley Square, Boston.

JOURNAL OF THE

Massachusetts Association of Boards of Health.

ORGANIZED 1890.

[The Association as a body is not responsible for statements or opinions of any of its members.]

Vol. XI. October, 1901. No. 3.

JULY MEETING

OF THE

Massachusetts Association of Boards of Health.

The quarterly meeting of the Association was held at Gallup's Island, Boston Harbor, on the afternoon of July 31, 1901, Henry P. Walcott, M.D., President, in the chair.

The President.— Will the Association be pleased to come to order? Will the Secretary read the records of the last meeting?

The Secretary read the records of the April meeting; and, there being no objection to them, they were declared approved.

Dr. Durgin.— There was an amendment to the Constitution proposed six months ago. I move that this be now taken up for action by the Association.

The motion was adopted.

Dr. Durgin.— I think Dr. Hill, the mover of this amendment, is present. He may have a remark to make.

Mr. Coffey.— Dr. Hill offered the following motion to amend the Constitution, and it was by vote referred to the Executive Committee: —

"At any regular meeting of the Association names may be proposed for election as honorary members. Such names may be voted on at the same meeting, if approved by the Executive Committee, and, if elected, shall immediately become members for life without dues."

The PRESIDENT.— This amendment has been favorably acted upon by the Executive Committee, and it is now before you for action. Is it your pleasure that this amendment to the Constitution be adopted? Is there anything to be said upon that subject?

Dr. DURGIN.— I move its adoption.

The amendment was adopted.

The PRESIDENT.— The amendment is adopted, and becomes a portion of the Constitution of this Association. The next business before the Association is the report of your Executive Committee. The Executive Committee reports as candidates for membership in this body: —

HENRY M. FRANCIS	Fitchburg.
Dr. J. C. BARCLAY	Clinton.
Dr. F. W. RICE	Brighton.
CHARLES E. BIRTWELL	Lawrence.
Dr. EDWARD M. HARTWELL	Boston.
Dr. CHESTER C. BECKLEY	Lancaster.
Dr. S. C. KEITH	Boston.
Dr. EDWARD J. SHANNAHAN	Taunton.
Dr. GEORGE K. ROBERTS	Attleboro.
J. ALBERT C. NYKEN	Brookline.
Dr. GEORGE P. SANBORN	Brookline.

On motion of Dr. Durgin the gentlemen named were elected members of the Association.

The PRESIDENT.— Is there any other committee prepared now to report?

Dr. Chapin (Providence) presented the following

REPORT.

At the annual meeting in Boston, in January, 1901, your committee was instructed to draw up a circular of advice relating to cleanliness

in school-children, designed to prevent infection from one to another by intimate and thoughtless contact between each other and their belongings. A meeting was held April 24 at the State House in the rooms of the State Board of Health by the courtesy of Dr. Abbott. Members present: Dr. Chapin (chairman) in the chair, Doctors Abbott, Denny, Theobald Smith, and Hill (secretary). A form of circular was drawn up, and ordered submitted to the Association at the next meeting. No report, however, was made at the next meeting in Worcester on account of lack of time at that meeting. It is therefore before you to-day.

The question of testing virulence in cases of suspected diphtheria was also referred to this committee at the January meeting; but the final report on this subject and on the results of the co-operative investigation into the prevalence of diphtheria bacilli in well persons are not yet complete. Your committee respectfully asks that a further extension of time be granted, and that a sum of money not to exceed $25 be appropriated for certain expenses connected with the printing of the reports for circulation, etc.

Dr. Theobald Smith has been appointed to, and has accepted, membership in the committee.

Respectfully submitted,

CHARLES V. CHAPIN, *Chairman.*

REPORT OF THE COMMITTEE ON "DIPHTHERIA BACILLI IN WELL PERSONS" IN REGARD TO TEACHING CLEANLINESS AMONG SCHOOL-CHILDREN.

It appears to the committee that a considerable number of children are infected with communicable disease, though they may be very slightly sick or often not sick at all. Such children mingle freely with others, and are according to our present knowledge the most fertile cause of the spread of communicable disease. If the communication between mouth and mouth can be lessened, it is hoped that communicable disease may be lessened. The schools seem to be proper places for inculcating that personal neatness

which would forbid the passage from mouth to mouth of any article.

Means suggested for the accomplishment of this object are : —

1. The instruction of teachers by an annual lecture or talk. The Teachers' Institute furnishes an excellent opportunity for this.

2. The distribution annually to teachers of a circular, a model for which is herewith presented.

3. If the town or city desires cleanliness and refinement taught, it must itself teach by example.

The free text-book system presents some obstacles to the development of the idea of privacy of personal property, but with care they can be overcome. Even with this system the pupil can in most instances have its own books, pencils, and slates for a term or year, and be held responsible for their condition. This should always be done so far as possible with everything that is furnished by the school department for the use of pupils. It entails more trouble for the teachers, particularly in the care of pencils, pen-holders, etc.; but with a proper system and some care these may be kept separate for each child. When books become decidedly soiled, they should be destroyed.

The use of modelling clay, if it is passed from one pupil to another, is objectionable, as it certainly gathers dirt from the hands. But, if each pupil's clay is kept separate, as it is done in many schools, its use may be permitted.

Children must not be allowed to use their saliva on their slates. Each child may be provided with its own sponge or cloth, and must not be allowed to use anything else for erasing. This is entirely practicable, and is frequently done. There are several reasons why it would be advantageous to abolish the use of slates, and the chief objection to this appears to be the expense. Nevertheless, the use of slates has been done away with in many schools; and it is recommended that this be done wherever possible.

The drinking-cup is perhaps the most common means of transmitting saliva from one to another, and its use should be abolished if possible. Separate drinking-cups might be provided either by the pupils or by the city school department. The use of a special style of drinking fountain to be used without cups has been recommended, but with this the committee has no experience.

HEALTH DEPARTMENT.

Suggestions for the Teaching of Cleanliness among School-children.

The poisons of some of the common and also of some of the most loathsome diseases are frequently contained in the mouth. In such cases anything which is moistened by the saliva of the infected person may, if it touches the lips of another, convey disease. The more direct the contact, the greater the danger.

It is the purpose of health officials to keep in isolation all persons having communicable diseases during the time that they are infectious. But in many cases this is impossible. Little restraint is put on certain mild diseases, as measles, whooping-cough, chicken-pox, and mumps, and even such diseases as diphtheria, scarlet fever, and tuberculosis are frequently so mild as to be unnoticed; and children affected with them mingle freely with others. It is probable that in such cases one of the chief vehicles of contagion is the secretion of the mouth and nose. It is believed that much can be done to prevent contagion by teaching habits of cleanliness. *But, if such instruction is to be effectual, it must be continuous. The teacher must notice and correct violations of those rules as habitually as the violation of the more formal school rules are corrected.*

Even if the question of disease and contagion did not enter into the matter at all, the subject ought to be given more attention by teachers. Our schools should not only teach reading, writing, and arithmetic; but it is perhaps quite as important that they should inculcate cleanliness, decency, refinement, and manners. Cleanliness should be taught for its own sake, even if it had no relation whatever to health.

TEACH THE CHILDREN

Not to spit: it is rarely necessary. To spit on a slate, floor, or sidewalk, is an abomination.

Not to put the fingers into the mouth.

Not to pick the nose.

Not to wet the finger with saliva in turning the leaves of books.

Not to put pencils into the mouth or moisten them with the lips.

Not to put money into the mouth.

Not to put pins into the mouth.

Not to put anything into the mouth except food and drink.

Not to swap apple cores, candy, chewing gum, half-eaten food, whistles, or bean-blowers, *or anything that is habitually put in the mouth.*

Kissing is a means of transmitting infection.

Teach the children to wash the hands and face often. See that they keep them clean. If a child is coming down with a communicable disease, it is reasonable to believe that there is less chance of infecting persons and things if the hands and face are washed clean and not daubed with the secretions of the nose and mouth.

Teach the children to turn the face aside when coughing and sneezing, if they are facing another person.

Children should be taught that their bodies are their own private possessions, that personal cleanliness is a duty, that the mouth is for eating and speaking and should not be used as a pocket, and the lips should not take the place of fingers.

The PRESIDENT.— Dr. Chapin's very valuable report will find its place in the printed report of the Association.

Next is a paper by Dr. White, which was left over from the last meeting. I think Dr. Hill will read the paper.

Dr. HILL.— Dr. White wished to present this paper in person, but, having recently been ill, is convalescing out of town, and asked me to read it for him.

AN APPARENT CASE OF DIPHTHERIAL INFECTION FROM WELL PERSONS CARRYING DIPHTHERIA BACILLI.*

BY FRANKLIN W. WHITE, M.D., OF BOSTON.

The history of the following case well illustrates several important points concerning the contagiousness of diphtheria.

The child whose illness we shall consider was two years old, of Italian parentage, and lived in a thickly settled tenement-house dis-

* Read before the Massachusetts Association of Boards of Health July 31, 1901.

trict of Boston. He was taken sick on the 12th of December with an attack of diphtheria of moderate severity, having fever and being confined to bed for two or three days only. Membrane was present on the tonsils, diphtheria bacilli were found in cultures from the throat, and he received three injections of antitoxin. Convalescence from this illness was rapid, and the child remained perfectly well; but positive cultures were obtained from his throat for the following three months.

Diphtheria bacilli obtained from the throat on February 18, about two months after the illness, were moderately virulent; and bacilli from the throat on March 3, nearly three months after the illness, showed a low but definite virulence. The tests for virulence were made by direct injection of solid culture into guinea pigs, and by injection of 48-hour old, or two weeks old, bouillon cultures into guinea pigs, the amount of fluid injected being one-half of the weight of the pig.

A 48-hour bouillon culture of the bacilli obtained on February 18 gave a decided local and general reaction in the guinea pigs, which, however, cleared up and the pigs lived.

The bacilli obtained on March 3, in 48-hour bouillon culture, gave a slight local reaction in the guinea pigs, followed by recovery. A two weeks old bouillon culture killed the guinea pigs in five days, producing a small necrotic focus at the site of inoculation, which contained diphtheria bacilli.

Four persons were more or less continuously exposed to infection from the first child during the three months in which virulent bacilli were present in his throat. Two persons, a boy aged four and a woman aged twenty-five, were in the same family; and two others, a girl aged six months and a woman aged eighteen years, lived in an adjoining room. The woman aged twenty-five had had diphtheria in childhood. None of the others had ever had the disease.

On February 1, nearly two months after the child's illness, a preliminary fumigation of the rooms was carried out, with the object of reducing the number of diphtheria bacilli about the premises and hastening their final disappearance.

On March 1, a negative culture was obtained from the child's throat, the house fumigated, and the child released from isolation,

the assumption being that the diphtheria bacilli in the child's throat were too few in number and of too little virulence to prove dangerous to others.

On March 3 cultures were made from the throats of the child and the four people known to be exposed to him. Diphtheria bacilli were found in the throats of the original child, of the boy aged four, and of the girl aged eighteen.

Three days later a second set of cultures were taken from the nose and throats of the same people. Positive cultures were obtained in the throat of the original child, in the nose and throat of the boy aged four years, and in the nose of the girl aged eighteen. Neither of the two exposed persons who had diphtheria bacilli in the throat was ill at any time during the three months.

The diphtheria bacilli from the original child showed a low grade of virulence even at this late date, as stated above. The bacilli from the throat of the four-year-old healthy boy showed an equal virulence. The virulence of the bacilli from the girl was not tested. Just after the release of the patient and disinfection of the house, two children, a boy of seven years and a girl of four years, came to the house from out of town, and were exposed to the children having bacilli in the throat for a day or two, and then returned home. Within five days the girl developed clinical diphtheria of moderate severity, was treated with antitoxin, and recovered.

This child was not attending school at this time, and not exposed, as far as known, to any other cases of diphtheria; and the evidence is very strong that she received her infection from these healthy children with whom she associated, and who had carried virulent diphtheria bacilli in their throats for nearly three months. (It is not known that cultures were taken in this case, and an unfortunate chain of circumstances has prevented our obtaining additional data.)

We cannot absolutely rule out the possibility of more than one source of infection in any case of diphtheria, and this case is no exception to the general rule; but at the same time we consider that the evidence of infection from the source cited is of the strongest possible kind.

The interesting features of this case are as follows: —

The long duration of virulent bacilli — namely, for eighty-five or

more days — in the throat of a child who had a rather mild attack of diphtheria, and who was treated with antitoxin.

The presence of virulent bacilli in the throats of two out of four of the child's associates nearly three months after his illness and after the premises had been twice fumigated.

The fact that these two associates had never had diphtheria and yet carried virulent diphtheria bacilli in their throats for a long time without developing the disease.

The fact that the persons not showing bacilli in the throat were of an age (six months and twenty-five years) when infection was less likely to occur.

The case shows that children who are frequently brought into direct contact with true cases of diphtheria often receive the virulent bacilli into their throats, and that these bacilli may persist for days, weeks, or even months. In some of these children no disease develops.

It shows that children associated with well persons carrying bacilli, even after fumigation of the premises, may contract the disease in spite of the low virulence of the bacilli.

It confirms the well-known fact that one negative culture does not guarantee that diphtheria bacilli have disappeared from the throat. It illustrates the need of more rigid isolation of diphtheria cases, especially in the tenement-house districts.

We always recognize that diphtheria patients ill or convalescent, or their discharges, are a source from which virulent bacilli may be obtained; but we must not forget that the healthy throats of individuals who have been in contact with them, and which may contain virulent bacilli for weeks and months without causing any lesion, are also a source of contagion.

We have a rule that no convalescent diphtheria patient may be released from isolation until one or two negative throat cultures have been obtained. It may prove a great advantage to add a further rule; namely, that associates of the patient must also show negative throat cultures before being allowed to mingle with healthy persons.

The fact that the majority of people and even the majority of children are not very susceptible to diphtheria is undoubtedly a great safeguard against more frequent infection.

I wish to thank Dr. Hibbert Winslow Hill for his kind interest and assistance in allowing me to carry out the bacteriological work on these cases at the laboratory of the Boston Health Department.

Dr. Hill.— I have a short note which I will present at this time, also from our own laboratory, on a different subject.

SURVIVAL OF TYPHOID BACILLI IN BODIES OF COOKED SHELL-FISH.

BY HIBBERT WINSLOW HILL, M.D.,

DIRECTOR BACTERIOLOGICAL LABORATORY OF THE BOSTON BOARD OF HEALTH.

It has been generally held that transmission of typhoid fever through oysters, clams, cockles, etc. occurs only when the latter are eaten raw; and as yet no clear case of transmission through cooked shell-fish has been recorded, so far as I am aware. Dr. E. N. Whittier (*Boston Medical and Surgical Journal*, May 9, 1901) attributed to oysters, cooked as a plain roast, three or four cases which occurred at Marion last year; but to my mind the proof was not conclusive.

Nevertheless, it is possible for typhoid bacilli in the interior of shell-fish to survive for a brief period the temperature to which they are subjected in certain forms of cooking.

In 1900 certain work connected with this subject was undertaken, and in continuation of this in 1901 the temperatures attained in different forms of cooking were ascertained by visiting the Boston Cooking School, the Touraine, and Marston's Restaurant. These were compared with the temperatures found in infected oysters experimentally cooked in the laboratory. The names of the cooking processes, the processes themselves, and the temperatures reached varied in all of these three places; but enough was found to show that typhoid bacilli within the body of shell-fish may at times survive the temperatures reached in some cases.

The temperatures used in cooking shell-fish do not remain constant for any length of time, but are characterized by a sharp rise and

a slow fall. It is generally accepted that 160° F. maintained for ten minutes will kill moist typhoid bacilli, but in few processes of cooking shell-fish yet noticed has such a condition been maintained. The problem is a somewhat intricate one, and the few figures I can as yet submit are suggestive only.

In order to be sure of finding the typhoid bacilli again readily, threads with a needle on them were dipped into a broth culture of typhoid bacilli and put through the oyster. Then the threads were cut off at the surface, leaving a piece in the middle of the oyster, which was removed, to recover the culture, after exposure of the oyster to the heat. It must be remembered that shell-fish, oysters and clams in particular, lying in sewage-polluted water, take into their intestines, and perhaps their tissues, the sewage bacteria. It is the bacteria in these situations, not those in the water outside the body (and inside the shell), which survive cooking, when any survive at all.

Oysters thus artificially infected with typhoid bacilli and immersed in boiling water yielded growths of typhoid bacilli when the period of boiling was one minute, the cultures being made immediately on removal from the water. Cultures made one minute after removal were also positive, but two minutes after removal were contaminated.

Infected oysters and clams, exposed for two minutes to boiling water, yielded positive results in cultures made immediately on removal, but failed to yield positive cultures one minute, two minutes, and three minutes after removal. Exposures to boiling water for three and for four minutes failed to give positive results.

The temperatures developed in the bodies of oysters, etc., prepared as for the plain roast, the fancy roast, the pan roast, in frying, and in some forms of chowder, fell below that similarly developed by two minutes' boiling in water. Some forms of roast fell below that found in one minute's boiling in water.

Of course, a very little heating, more or less, will decide the matter in any given case. While no very striking new source of infection has been unearthed, yet a good reason for investigating the exact facts concerning even "cooked" oysters, where oysters are in question as means of infection at all, is supplied.

I may say that the work, from a rush of other things, was rather incomplete, and that only the actual facts found can be regarded as

being of any value at all. The negative results particularly require further confirmation.

Dr. Keith.— I should like to ask Dr. Hill whether the cultures from the affected persons were placed inside or merely outside of the oyster, and the methods employed in making the test.

Dr. Hill.— Oh, inside. Without question, if they were on the outside, they would be killed during cooking.

Dr. Denny.— Dr. Chapin in his report asked for an appropriation of $25 to pay for printing the report of the committee. I should like to move that $25 be appropriated for that purpose.

The motion was adopted.

Dr. Durgin.— I move a vote of thanks to this committee who are doing such noble work for the Association and for the community.

Mr. Pilsbury.— I second the motion.

The President.— It is moved and seconded that the thanks of the Association be given to our very able and very industrious committee upon this subject.

The motion was adopted.

Dr. Chapin, Providence.— If it is in order now, I should like to propose the name of Professor F. F. Westbrook, of Minneapolis, as an honorary member of this Association. He has been of very great assistance to our committee in its work, and has furnished us with a good deal of material and with plates illustrating the different forms of bacilli for the use of members of the committee and the workers with us.

The President.— I am sure that, if the Association was familiar, as some of us are, with Professor Westbrook, it would most heartily welcome his addition as an honorary member.

Dr. Durgin.— I very gladly second that motion, knowing the gentleman well and feeling that he would be a valuable acquisition to the Association.

The President.— It is moved and seconded that Professor Westbrook be elected an honorary member of this Association.

The motion was unanimously adopted.

The PRESIDENT.— The next paper of the afternoon is by Dr. Theobald Smith, upon "The Etiology of Malaria, with Special Reference to the Mosquito as an Intermediate Host." I have the pleasure of presenting him to you.

THE ETIOLOGY OF MALARIA, WITH SPECIAL REFERENCE TO THE MOSQUITO AS AN INTERMEDIATE HOST.*

BY THEOBALD SMITH, M.D.

Mr. President and Gentlemen of the Association,— The subject which I am to bring before you to-day has aroused so much interest in the medical profession, as well as among the public, that there appears to be very little to say which has not already appeared somewhere in print. Inasmuch as physicians, sanitarians, zoölogists, and entomologists have taken part in these investigations, and since the latter have been carried on over the entire civilized world, the number of specially interested scientists is very large. Moreover, the subject has been of more than ordinary importance to the colonizing nations of Europe, and also to this country, who have learned to regard malaria as the greatest foe which their extending empires have to meet.

In view of the large amount of more or less fragmentary information which has already been published in various journals, it has seemed to me that I can serve the purposes of the Association best by giving a very brief connected survey of the whole subject, by referring only to fundamental principles and illustrating them, as far as possible, with specimens and diagrams.

The subject as it has been developed within the last twenty years divides itself easily into three different lines of research. The first and earliest in history is the study of the disease itself from the physician's standpoint,— the clinical manifestations of the disease, and the recognition of different types according to the fever curve, the discovery of the parasite in the blood, and its use for diagnosis

* Paper stenographically reported and revised by the author.

and treatment. The second is the study of the parasite itself, its life history, as well within the human body as outside of the human body, more particularly in the mosquito, and its various stages. That is a subject quite apart from the former and one to which zoölogists have devoted a great deal of time. The third and final step is the study of the intermediate host itself, of the mosquito in other words, the different species and the particular ones that transmit malaria, the life cycle of the mosquito, its breeding-places, and the means of destroying it. This third and final step has been undertaken with the co-operation of entomologists and zoölogists over the entire world.

I wish to speak very briefly of the first phase of our study; namely, the malaria parasite as it occurs in the human body. You probably are all aware that this little parasite, which lives in the red blood corpuscles of man and destroys them, was first discovered twenty years ago by a French military surgeon, Laveran. For a number of years after its discovery it received scant attention, and it was either passed over in silence or regarded as a fiction. This was especially so in Germany, which is to-day taking such a leading part in the study of malaria. The subject remained comparatively unnoticed there for ten or fifteen years, because probably there was no malaria in that country to create an interest. In 1885 to 1889 the Italians paid a great deal of attention to the malarial parasite in the blood; and very prominent among them was Golgi, who studied its life cycle in the blood corpuscle. He watched its growth as it entered the red corpuscle, saw it finally enlarge until it was as large as the red corpuscle, and then break up into a number of little bodies, which are called spores, and which again enter the red corpuscle to start the disease anew. Here are some diagrams which illustrate this. Golgi found that in certain types of fever this breaking up into spores occurs at the end of forty-eight hours, and that gives us the tertian type of fever, the fever occurring at the time of the sporulation. He also found that there were certain other types of fever, in which the spore formation occurs at the end of seventy-two hours; and that gives us the quartan fever, which is, however, a rather infrequent form of malaria. He also found a third type of fever, which is the pernicious type, the irregular, tropical type of fever, which we do not encounter in this latitude, but which occurs in most parts of the

tropical and sub-tropical world. In the tropical climates all three types of fever prevail.

While these investigations were going on, the knowledge of the malarial parasite was extended in various directions. It was found that little bodies live in the red corpuscles of frogs, turtles, lizards, and snakes; and these were studied by zoölogists, and the studies which they made contributed largely to the success of the recent studies upon human malaria. It was also found that birds harbor malarial parasites. The crows, pigeons, finches, and sparrows in different parts of the world are also affected with malaria, which has been thoroughly studied, and which is the foundation of part of our knowledge of the final results in connection with the mosquito as transmitter. It was also found that the parasite occurs in mammals. It was found in cattle, in sheep, and latterly in dogs. In these mammals it produces severe and destructive diseases. Thus during this period the study of malaria was extended to the lower animals; and it was found that man was not the only one who was affected with malaria, but that similar diseases occurred among animal life. At the same time all efforts to prove that these parasites of animals were able to infect the human subject, or that the human malarial parasite was able to infect animals, proved a failure. These parasites are all peculiar to the species which they inhabit: they are not transferable from one species to another. This it is important to bear in mind, because no animal excepting the mosquito can carry or transmit human malaria.

These studies have led to a very valuable feature of clinical medicine to-day, and also of sanitary medicine,— our ability to diagnose malaria by an examination of the blood, either fresh or dry. All of you probably know that since 1895 the State Board of Health has utilized the method of blood examination to aid physicians in different parts of the State to recognize malaria in doubtful cases. As you also probably know, cover-glasses are sent out in these little capsules, and films of blood are spread upon them, and they are sent back to the laboratory for diagnosis. This first step in our knowledge, the study of the malarial organism in the blood, has proved of inestimable advantage in the recognition of malaria and in its differentiation from other types of disease.

There was no doubt of the fact during this time that our knowledge was very incomplete. The current theory of malaria, that the germs exist in the soil and in water, was incapable of explaining the incidence of the disease. In fact, this old theory was like an old outworn creed: nobody could actually disprove it, but nobody was really satisfied with it and no biologist could believe in it any longer. Therefore, the time was ripe for some new discovery; and this came in the shape of the study of the parasite outside of the body, in another animal, in the mosquito. The discoveries which led up to this fact, however, are quite numerous and due to many minds. It is worth while to bear in mind that the mosquito theory, or at least the theory that insects carry malaria, is said to be recorded in the writings of the ancients; but, however that may be, it was a fairly well-known theory during the present century in this country. In 1848 Dr. Nott, of New Orleans, forcibly emphasized the probability of the mosquitoes carrying malaria; and in 1883 Dr. King, of Washington, D.C., wrote several articles strongly supporting the malaria theory. But the first impulse toward the scientific study of the relation of mosquitoes to malaria — in fact, the first indication that it was worth while to spend any time upon it — was given by the studies of malaria in animals. Here is a chart which shows the malarial parasite of cattle. In 1890, 1891, and 1892 it was definitely demonstrated by the speaker and F. L. Kilborne that this malarial disease is transmitted only by a parasite, not an insect, but one that stands close to the insects, a tick, and that it can only be transmitted by such an animal.

These demonstrations gradually led observers in different parts of the world to insist upon the probability of the mosquito theory of malaria, most of the writers on the subject stating that very likely the mosquito was the intermediate host. In 1894 Manson began to emit his theory of the mosquito as the intermediate host, but his theory was faulty. He claimed that the mosquito draws the blood, and with it parasites, out of the human body, and that they mature in the mosquito, and that, when the mosquito dies, these spores that are produced therein are scattered to the winds and inhaled. They reach the water, and are taken into the body with it. According to Manson, infection occurs through the water and food as well as through the air. In 1898 one of Manson's pupils, Ross, in India, finally was able

to demonstrate that malaria of certain birds is transmitted by the sting of certain mosquitoes belonging to the genus Culex, and that in Culex they undergo a certain complicated transformation, become ripened, as it were, and after they are ripe, after a number of days, the spores are discharged back into another bird that is bitten by the mosquito. This cycle is given in this diagram, and I shall briefly describe it in connection with another part of my remarks.

R. Koch also took up the subject in 1898. He was stimulated to carry on his researches by the fact that he found in Africa the malarial disease in cattle (Texas fever), which was first studied in this country, but which is now found entirely around the globe, in the tropical and sub-tropical zones. He was able to confirm earlier investigations which showed that this disease could be produced by putting on animals the cattle tick which carries the disease. He at once set to work to study human malaria in different parts of the world, and added very materially to the knowledge which Ross had given us. Then the Italians took it up, and they are still busy with it. They formed a society for the investigation of malaria; and one of their zoölogists, Grassi, studied the mosquitoes very thoroughly, and the life history of the parasite in them, and materially completed our information upon that subject.

I presume you have read a great deal about the parasite of malaria; but it is a very complicated organism, and I think it is well to have some idea of the fundamental processes through which this organism passes. It belongs to the *Protozoa*, as you probably all know; and under the *Protozoa* it belongs to a peculiar class of parasites, which are the true parasites of animals, the *Sporozoa*,— some of them very dangerous. Under the *Sporozoa*, it belongs again to another, smaller group, which we call the *Coccidia*.

Now let us briefly look at this cycle of the malarial parasite; and we may take for this purpose this diagram of the malaria in birds, because it is the same as in man. The parasite enlarges, divides, and each spore passes back into a fresh red corpuscle, to again enlarge and divide into spores, the number of times this goes on depending on the treatment. If the patient remains untreated, the number of chills (each chill corresponding to sporulation) may be indefinite. If the patient is treated with quinine, they disappear. At a certain

stage in the life history of the parasite in the blood it no longer divides in this way; but the body goes on to assume two other forms, which are represented here. These other bodies grow large, nearly fill the corpuscle; and they continue to develop, each one in his particular way, into what are now known as male and female bodies. Here is the female body, and here is the male. When blood is withdrawn from the body and placed under a microscope, the male body after a few minutes will be seen to break up the corpuscle in which it is contained, and to throw out these flagella which you see here and which become violently agitated. These flagella seem to break away. They have been seen to bury themselves in the body of the female organism. In other words, we have a case of true sexual reproduction here in one of the most minute of animal organisms.

This fertilized body undergoes certain changes in the mosquito, which lead finally to the formation of bodies which enter the red blood corpuscle again; and this occurs in the following way: If we take the blood of birds and put it under a microscope, we can observe the process of fertilization going on. Then, after about an hour or two, the fertilized body gives rise to a little worm-like body, which gradually works its way out of the fertilized female body, and which moves about for a certain length of time; and then nothing more happens to it. The process is stopped because it is under the cover-glass. But, if we take the parasite and allow the mosquito to draw the blood, then this body forms in the stomach of the mosquito. In the stomach of the mosquito the fertilization takes place. The fertilized female gives rise to this little worm-like body. This makes its way through the stomach of the mosquito and reaches the outer layer of the stomach. Here it remains under the covering of the stomach. It slowly enlarges; and in five or six days the interior is broken up into an immense number of little rod-like bodies, which are only three or four times as large as a big bacillus, for instance. The mother body finally ruptures, and these little sporozoites get into all parts of the body cavity of the mosquito. They reach the poison or salivary glands in the anterior portion of the body, which is represented here in section; and here you see immense numbers of these little rod-like bodies which have collected in the salivary glands. Here is the stomach of a mosquito with these little bodies. After the parasite has worked its

way through the stomach and appeared under the serous, or outer, covering, it forms these little nodules, which are represented by these bodies here. And here is the stomach of a mosquito with these little bodies attached, in which is going on this division into these little bodies, which we call sporozoites. When they reach the salivary glands in the body, they are discharged at the first opportunity which the animal has of stinging any susceptible subject. They enter the human blood, penetrate into the red blood corpuscles, and there pass through the cycle already described, which gives rise to the fever.

Before this remarkable development had been discovered, a certain number of studies upon similar *Protozoa* (*Coccidia*) had shown that these organisms were true sexual organisms, so that this cycle which I have just pointed out was not entirely an original discovery with students of malaria. They had received a great deal of help from zoölogists who were studying other forms related to these, but of apparently no economic or sanitary significance. They were simply studying zoölogical objects, but in so doing they at the same time threw strong light upon the life cycle of the malarial parasite. These other parasites which they studied undergo this entire change in one animal; but in malaria the change is spread over two bodies, the human body as well as the mosquito.

The time required for this parasite to pass from the red blood corpuscle into the mosquito and to develop there until it is ready to pass out again is about ten days in favorable hot weather, so that, if a mosquito is infected to-day with blood from a patient, in about ten days that mosquito is ready to discharge these little bodies from its salivary glands into man again. The period of incubation in man is about ten days, so that twenty days would elapse between one case of malaria and another as the shortest possible interval. Of course, this interval may be greatly lengthened out by cold weather. For in cold weather the evolution of the parasite is greatly retarded in the insect.

Now a few words in regard to the mosquitoes themselves. In consideration of the large number of species which occur in most localities — it is said that there are not less than 250 species that have been determined in the entire world — it is, of course, a problem of the greatest importance to find out which species cause malaria and

which do not. In solving this problem, perhaps no one has done more than a certain Italian zoölogist, Grassi, who studied the distribution of the mosquitoes in Italy. He found — and his work has been since that time confirmed — that of the two great genera of mosquitoes that are commonly found in various localities, *Culex* and *Anopheles*, *Anopheles* is the one that carries malarial parasites. By making careful comparative studies with infected *Culex* and by allowing patients to be stung by *Anopheles*, he reached the conclusion that the genus *Anopheles* is the one which transmits human malaria, and that *Culex* has nothing to do with it. From this position Koch dissented several years ago, when he studied the disease in Italy; and he claimed that probably also some species of *Culex* transmit the disease. But I am not aware of any further statement of his upon the subject; and I think we must rest contented with these statements for the present, since the Italian scientists have made personal and very thorough investigations into this subject.

The life history of *Culex* and *Anopheles* is now given fully in various books,* accessible to all of you, so that I shall not go into any details concerning them. I simply wish to say a few words, which will be greatly re-enforced by the presence of certain developmental stages of these species which I have in this glass. Owing to pressure of other duties which I had to attend to, I was unable to get sufficient material to demonstrate the development of the mosquito to you; and I am very much indebted to Mr. Underwood, who was kind enough to bring over to-day for my use and for your inspection the larvæ of both *Culex* and *Anopheles*, which he has been fortunate enough to collect, and some of which he has been able to rear into the full-fledged mosquito.

The development of the *Culex* is briefly this: The adult insect lays its eggs upon a quiet pool of water, and within a day the larvæ hatch out. These larvæ are probably familiar to you as the little slender wrigglers which occur in standing water. They live in this guise for some days, when they change their form and position and become pupæ. The pupa lives several days in the water. Then the membrane splits, and the insect rises from the remains of the pupa. The shortest time that it takes the adult insect to develop

* L. O. Howard. Mosquitoes. 1901.

from the egg is about ten days in hottest weather, but this period may be lengthened more or less indefinitely by untoward cool weather. With *Anopheles* the development is in general the same. The insect passes through the stage of larva and pupa, and then the full-fledged insect appears; but it takes *Anopheles* at least twenty-five days to develop, whereas *Culex* requires only on an average about fifteen days. The appearance of these larvæ to one who has not paid very much attention to them is nearly the same; but, if you examine these two lots of larvæ, one *Culex* and the other *Anopheles*, you see some very marked differences. The one that strikes you at once is the fact that the larvæ of *Culex* hang down obliquely from the surface of the water, whereas the larvæ of *Anopheles* remain near and parallel to the surface of the water where they feed. In regard to the adult insects the differences, of course, are such as require study to appreciate. Those who have once seen the adult *Anopheles* and the adult *Culex* will not fail to recognize them again.

There is only one point to which I wish to call your attention in the adult insects. This is the drawing of a male *Anopheles*, the malarial mosquito, which has these little spots on the wings. You notice that the male has these bushy antennæ, which are inconspicuous in the female. But in *Anopheles* both male and female have these long projections from the head, which we call the palpi; and in *Culex* they are present only in the male. The palpi of the female *Culex* are very short and stumpy. If you find female mosquitoes in this climate which have these long palpi extending from the head, then you have *Anopheles* to deal with. But there are other differences which can be easily recognized by seeing the species; and I have brought with me to-day a number of species of *Culex* and also the two species of *Anopheles* which are supposed to transmit malaria, which were caught in the suburbs of Boston, and which you may inspect at your convenience. There are these two species of *Anopheles* in this part of the country, the *A.* which corresponds closely to and is supposed to be identical with the malarial mosquito which has been studied in Italy, and another *A.*, whose malaria-producing powers have not been demonstrated. But, as I said a moment ago, we may take for granted that both transmit malaria until the contrary has been definitely proved.

The breeding-places of mosquitoes are familiar to all who have

lived in the country. There are supposed to be some differences between breeding-places of *Culex* and *Anopheles;* but, after reading the reports of different observers from different parts of the world, including South Africa, I am inclined to think that the differences are purely local, and that we are likely to meet *Anopheles* almost everywhere where *Culex* breed and where the temperature is high enough to enable them to develop. The favorite breeding-places of all of these insects are quiet pools of water in the vicinity of streams which have been separated off from the main current by subsidence or drying up, and which are not accessible to fishes. In these warm pools the insects deposit their eggs on the surface. The larvæ live for a number of days in the water until the full-fledged insect appears. Only a week ago I noticed near the base of Mount Washington, in a mountain stream, a large number of rock pools, which had been excavated by the churning of the water in a very hard variety of granitic rock. In these rock pools there were myriads of *Culex* larvæ. These pools contained very warm water, due to the heating of the rock by the sun's rays. In that way the larvæ obtained all the heat they needed for their development into adult mosquitoes. But, in examining the pools which were fed by little rivulets which came out of the rocky crevices, and in which the water was rather cold, I was unable to see a single larva. There are several reasons why this condition may have prevailed. It is possible that the surface current of water, which was very feeble indeed, might carry off the eggs into the main stream, it might carry off the larvæ that came to the surface to breathe; but I am inclined to think that the differences were due largely to the difference in temperature. One pool was fed with cold water, the other was isolated and was brought up to a temperature of probably 25 to 30 degrees C. by the warmth of the rocks, which were heated by the sun's rays.

With these investigations in view, I think it is very easy to harmonize the old and the new views of malaria. That malaria should arise in swampy land is easily harmonized with the old theory, because mosquitoes need water to breed in and they cannot breed on dry land. The larvæ are aquatic, and must live in water. Consequently, the proximity of water is a necessity to the production of mosquitoes, a necessity to the development of malaria. It is more difficult to

explain those conditions under which malaria appears when large public works are undertaken, when canals are dug, railroad embankments built, and drinking water and sewerage introduced into towns. Here there is simply the overturning of the soil. The old theory, that the malarial organism lives in the soil for untold ages, until it is turned up, is utterly ridiculous, and cannot be entertained any longer; and the question arises, How is it possible to account for malaria appearing under these circumstances? It is well known that it does appear almost always under these circumstances, or it has done so in the past, at any rate.

There are several conditions that we should take into account. In the first place, all such work involves the temporary formation of inequalities of the soil, the interference with the natural shedding of the water from the soil, and the consequent formation of puddles in which mosquitoes may breed. Then, in the economic conditions which prevail to-day, it has been customary, in order to get work done, to import laborers in large numbers from different places and to keep them near the work; and this has given rise to the formation of laborers' camps. These camps have generally been near a source of water, because proximity to water was a necessity for camp life. Sometimes this water was running, sometimes it was stagnant. Then a third condition was the introduction of individuals who had probably been through a number of malarial epidemics in other parts of the country where they had been at work, or who were brought from foreign countries where malaria is endemic in all its forms. We have, then, the very conditions that are necessary to produce malaria. We have the infected individual, we have an opportunity for the mosquito to breed, and we bring the infected individual in close contact with the breeding-grounds of the mosquito. I think that these facts are sufficient to explain, in accordance with our present theory of malaria, the existence of this malady under conditions which I have described.

In conclusion, I must say a few words about the means by which malaria can be suppressed. It is the hope, or it has been the hope, of most European countries that these investigations would rid their colonial possessions in Africa and in Asia, for instance, of the worst scourge to the white man, malaria. Whether this will ever be possible

is questionable; but it does seem to me that in our own climate, in a State like Massachusetts, it should be entirely possible to eradicate or to suppress malaria, to see that it does not assume epidemic forms such as have prevailed occasionally in the immediate past. The things to be done are threefold, and they have been accepted by all sanitarians and all students of the subject of malaria. The first thing is to endeavor to rid the neighborhood of mosquitoes; the second is to protect individuals from the bites of mosquitoes, as far as possible; and the third is to protect the sick from the bites of mosquitoes, to prevent the dissemination of infected mosquitoes, and also to treat carefully all cases subject to relapse.

The destruction of mosquitoes requires the drainage of the soil as the only means by which they can finally be removed. Cultivation and tillage of the soil will tend to the removal of puddles. In densely populated countries this has been done, so that in Germany, for instance, where every foot of land is under cultivation, there is practically no malaria. In our own country, where there is an immense amount of land which is left to take care of itself, where the railroads have had full sway in cutting off the natural drainage of the soil by embankments which are not properly drained, there is still a great opportunity for mosquitoes to develop and to spread disease. To suppress these mosquitoes is the great problem of the future. It will eventually be done, with the increasing population; but it is hardly worth while to wait for that time when every foot of land will be taken up and put under cultivation.

The destruction of mosquitoes should be undertaken by communities rather than by individuals. But here public health again meets a good many opponents, who are either sceptics of the theory or who do not care to undertake their portion of the task. I read a paragraph in one of the New York papers some weeks ago, which states the case very graphically. Certain objectors to the destruction of mosquitoes claimed that, when kerosene was used and poured upon these puddles to destroy the larvæ, the mosquitoes themselves became so loaded with kerosene that, when they flew into the lamp at night, they became ignited, and converted into dangerous sparks liable to set fire to dwellings. This is one of the arguments which the rural genius is apt to breed, and which are so injurious to the work of public health authorities.

You probably are all familiar with the different methods which are in use in destroying and suppressing mosquitoes; and it is hardly worth while for me to go over that ground, especially as the daily press is ready to inform any one upon these subjects. You know that the palliative of pouring kerosene upon puddles is a very good one, but any remedy of that sort is merely palliative. The thing is to get rid of the puddles, because the kerosene will sooner or later disappear, and give rise to a new crop of mosquitoes. But such methods as the use of kerosene, the addition of lime to puddles,—which causes alkalinity of the water,—are very good means of destroying mosquitoes until we can get some better method of destroying their breeding-grounds.

The protection of the people from mosquito bites is a very simple procedure, and easily carried out. The proper screening of houses is cheaply done. Communities in malarial regions should be warned of the danger of the open after sundown. Recently the Italian investigators have published some very striking statistics concerning the value of such preventive methods in countries that are saturated with malaria. Different men of the malaria commission undertook to protect, experimentally, the men who were compelled to live along the railroad tracks of the different Italian railroads passing through very dangerous malarial swamps. They personally supervised the experiments, provided the houses in which these railroad officials lived with proper screens, provided double doors, and regulated the lives of the people in such a way that they could not be exposed at night. The statistics which they publish for the years 1899–1900 show that fully 90 per cent. of such people remained free from malaria in some of the worst parts of Italy, and that, of those people who were not properly protected, nearly 90 per cent. suffered from malaria during the season. The method of protecting people by keeping away the insects in some mechanical way or other is thus a very valuable means, especially in places where there is always danger of contracting malaria.

The third demand made by the results of studies in malaria is the thorough treatment of all cases of malaria. Their protection from bites and the treatment of relapses of course come in as a necessary corollary to what I have said. I believe that the relapsing cases are

probably the sources of spring epidemics. Persons who have become infected in the fall, who have had a few chills, and who have been cured by quinine, may be well during the winter; and early in the spring they suddenly have a fresh chill. Such persons have carried a malarial parasite in their blood during the winter; and, given seasonable conditions in the spring, they may be the starting-point of epidemics later on in the season. They infect the earliest broods of mosquitoes, and these have ample opportunity to spread the disease over a large region, and to form a number of foci of the disease; and the entire summer is likely to be a summer of malaria. The earlier the infection takes place, the worse for any particular locality. It is a strange fact that in the malaria of cattle, of which the parasite is shown in this diagram, the animals that are perfectly immune carry this parasite throughout their life in the blood. They can always be used as sources of infection. It is quite probable that similar conditions prevail in human malaria,— that, if persons who have lived for years and years in malarial countries and have passed through frequent attacks have once become immunized, they may carry the parasite indefinitely in their blood or else become readily reinfected by the mosquito without showing any disease themselves. I am inclined to think that the future will show that it is not the freshest cases of malaria that are the most dangerous; but it is the old cases of malaria, the cases which do not show any visible disease, but which carry the parasite in its perfect condition, ready to form the sexual bodies which pass into the mosquito, and there continue their evolution until the sporozoites are ripe.

In conclusion, I should like to speak of one interesting feature; and that is immunity to malaria. If you read the older text-books on medicine, you will find that they all state that there is no immunity to malaria, that persons can have attack after attack without showing any spontaneous improvement or without becoming well spontaneously. This is true to a certain extent, but it is not entirely true. Persons probably could become immune, but it takes a long time. It takes a long time for individuals to reach that stage when they can expose themselves to malaria without becoming ill. And, strangely enough, this has been demonstrated by Koch in his African studies. He found in some of the villages where malaria prevails that the

children all had malaria, they all had an enlarged spleen, and they had the appearance of being under the influence of the malarial poison; but, as these children grow up, they lose the enlarged spleen, they no longer have chills, their blood no longer contains the parasites in demonstrable numbers, and, when they have become adult, they are no longer susceptible to malaria, they have become immune to it. The same is true in the malarial disease of cattle. The young animals that are born in infected territories may have frequent attacks while they are young. They grow up, and become absolutely immune to the disease. But, strangely enough, they always carry this parasite in their blood. Their blood is always infectious to those that are susceptible. There is thus an immunity to malaria; but that immunity is of no consequence to us, because it would not pay us to become immune. We should probably die before we reached that stage when immunity was attained. The reason why we do not become immune is because, as soon as malaria has developed within us, we are treated; and the parasite dies. The system does not undergo the peculiar influences of the parasite during long periods of time, which lead to immunity, so that after a patient is treated for one attack of malaria he may contract that disease again another year, he may contract it as long as he lives, because he is cured at once, the malarial parasite has no chance of modifying his system; and, consequently, he is always susceptible. I think it is this fact which has led physicians to speak of malaria as a disease toward which we cannot acquire immunity. There is no difference between malaria and other diseases in that respect excepting in this, that it requires a very long time, and it probably demands a very youthful system, to withstand malaria, before full immunity is acquired.

I should like to have those of you who are interested examine these larvæ of *Anopheles* and *Culex*, and also these specimens of adult mosquitoes, showing the malaria-carrying species, *A. quadrimaculatus* and *A. punctipennis*, because they are rather rare in this locality.

The PRESIDENT.— Dr. Smith's paper is before you for discussion or question. There is one important subject that has not been acted upon, and that is the next meeting of this Association. There has been no urgent invitation brought to the attention of any officer or

any committee of this Association from any municipality eager to entertain the Association at its October meeting, and I presume there must be such a municipality. But the officers of the Association will be content to receive a private notification of the desires of the municipality within the next month or two.

Is there any other business to come before the Association? Any discussion?

Dr. CHASE.— Mr. President, before we adjourn, I hope there will be an opportunity of asking, through you, of Dr. Smith some advice for the action of boards of health. Is it not essential that certain places, like the Charles River basin and the Neponset River basin, be drained, in order to get rid of the pools and breeding-places of mosquitoes? In regard to the use of kerosene, of which we have heard, I should like to inquire how much kerosene per yard of surface should be put on the water, and how often. Doubtless there are other practical points that we might learn from Dr. Smith before we adjourn.

The PRESIDENT.— These questions are certainly very practical questions, eminently practical, before such an Association as this. I don't know that we possess that positive information that Dr. Chase asks for.

Dr. CHASE.— Perhaps the Doctor would be willing to suggest some details.

The PRESIDENT.— I should like to ask if Dr. Smith has any knowledge of such details.

Dr. DURGIN.— I would suggest that we have yet three-quarters of an hour before it is time to start for Boston. This is one of the most interesting papers that has ever come before this Association, and it was expected that members of boards of health throughout the State would be ready with practical suggestions for dealing with this great question. Dr. Smith, I am sure, is ready to answer any question that might be asked as to practical ways of fighting the mosquito.

The PRESIDENT.— Dr. Smith, will you answer the question?

Dr. SMITH.— Mr. President, about ten years ago Mr. Howard, of the Department of Agriculture, suggested that kerosene would be an excellent means of destroying the larvæ in pools, owing to the fact that it forms a very thin film on the surface, and, as the larvæ come up to breathe and their respiratory siphon touches the surface, they

are unable to get the air on account of the oil. This was an old remedy, but he resuscitated it and used it successfully. I think that, if any one wished to get accurate information concerning the quantity of kerosene to use per square foot or per square yard, he would undoubtedly be able to obtain that information by writing to Dr. L. O. Howard, of the Agricultural Department at Washington. There are a number of publications upon the substances to be used, especially the Italian journals, where various soluble substances have been tried, among them anilines and oils. I think these two sources would probably give all the information desired in regard to the amount of these substances to use. But, as I said in my remarks, the use of kerosene is merely palliative; and, while it is good for the time being, it will by no means reach the object finally desired.

Dr. Hill.— Perhaps I may be pardoned, Dr. Smith, for saying that I happen to remember that Dr. Howard suggests one ounce to fifteen square feet. "Light fuel oil" is the commercial grade which he recommends, one ounce to fifteen square feet. The frequency of use is from two to four weeks. Of course, a very still pool, where there was very little loss, would not require application quite so often as where there is more or less constant flow. I recommended every ten days or oftener, in order to interfere with the cycle of life of the mosquito, in a case where a spring containing larvæ was found in the basement of a Boston hotel. Experiments I have made show that half an hour under a coal fuel oil is sufficient to drown the larvæ or at least weaken them beyond recovery.

Mr. Underwood.— I would say that Dr. L. O. Howard has written a book called "Mosquitoes: How to Destroy them, How they Live, and How they carry Disease." That book can be bought, and it is now on sale at all the bookstores. In it he describes very fully all about the mosquito, how it can be killed, and tells just how much oil to use and the kind of oil, and where it has been tried in the different sections of the country, and what progress has been made along those lines. In Belmont we have had quite an experience with fighting the mosquito by draining the lands in the neighborhood of Hill Crossing. Any of you that have passed by there on the Fitchburg road have probably seen the great swamp that the road goes through. And, by the way, that land has been covered with water

partly through the railroad's having gone through there and built embankments, throwing this water back. Last year, through the co-operation of the Cambridge Board of Health and the Belmont Board of Health, we drained a considerable portion of these meadows; and the testimony of the people who have lived in the vicinity is that this year there are not as many mosquitoes as usual. We hope to still further benefit that section by getting Somerville and Arlington to co-operate with Cambridge and Belmont, and still further drain Alewife Brook, which is the key to the whole situation. You will be interested to learn that we have found in that locality a great many of the *Anopheles* mosquitoes, or the larvæ, and the adult mosquito. We hope that the people of the community will take hold of the question, and will see if something still further cannot be done. Probably the area is too large to cover with kerosene, and the only remedy that we think efficient will be the ultimate draining of the whole district. There has certainly been, as all Cambridge and Arlington physicians can testify, a great deal of malaria in the neighborhood.

Dr. Howe.— I have understood that kerosene should not be used in bodies of water where animals are likely to drink. I would also like to ask whether fish should be considered. In our village there is a pond which is stocked with gold fish, has been stocked with gold fish for years, but whether it would be prudent to put kerosene on that pond?

Dr. Smith.— I should think the wisest thing to do would be to examine the pond to see whether any larvæ live in it. It may be that mosquito larvæ cannot live in it. Dr. Howard says that one of the most reasonable of the recommendations which have been made from time to time is the application of kerosene to restricted and fishless breeding-ponds,— fishless, because the fish are very likely to destroy the larvæ.

Mr. Underwood.— I should like to state, in regard to the gold fish, that the *Anopheles* which you have seen in those bottles to-day were taken out of a tank within fifty feet of a gold fish pond; and I have been unable to find any larvæ in the pond where the gold fish are, So it seems evident that the fish are eating up the mosquito larvæ. Furthermore, I have put these fish into an aquarium where I have seen them eat the larvæ with great relish. I observed that one fish ate eleven in as many minutes.

Dr. Durgin.— I should like to ask Dr. Smith if it makes any difference in the breeding of the mosquito if these little pools of water are mixed more or less with salt water.

Dr. Smith.—There are certain species that do breed in brackish water; but whether *Anopheles* breeds there, I think, has not yet been determined.

Dr. Abbott.— Mr. Chairman, there is another practical point in connection with this matter of the application of kerosene oil, and that is the spreading of it by agitating the water. A single drop of kerosene oil will cover upon a quiet pail of water about an inch; but the slightest agitation of that will cause the drop to spread over nearly a foot,— that is, over the whole surface of the pail. I found that the application of fifty cubic centimetres — that is, an ounce and two-thirds — to a small pool of stagnant water would spread at first, when laid upon the water quietly, over only about a foot; but brushing the surface with a switch would very soon spread that over about a square yard, and a day or two afterward I found that that had become still much more diffused. There is another point, and that is the effect of the wind upon mosquitoes. On a little island, or practically an island, in Buzzards Bay, there are no mosquitoes when the wind is in a certain direction; but the island being about a quarter of a mile from the shore, just as soon as the wind shifts into the east and carries the wind from the shore, the mosquitoes prevail until the wind changes again. Another practical point is in regard to fish. There is one fish that I once observed, not necessarily eating the larvæ of mosquitoes, but, what is practically the same thing, the eggs; and that is the horn-pout, commonly called in Southern waters the catfish. The horn-pout has a horizontal mouth, not a round mouth. That mouth, it seems to me, is made for a certain purpose. From observations I made upon a pout that I tamed and kept in a tank during the whole summer season,— this was many years ago,— he would come up to the surface and feed upon earth worms offered to him; but that same horn-pout, in the evening, would come to the surface and sweep the water one way and another with his mouth where the eggs are always deposited. So that, in taking in those eggs he destroys, of course, what the fish might be a long time in destroying in the shape of larvæ. I mention this and the matter of spreading the kerosene oil as practical points in the destruction of the larvæ.

Dr. Howe.— Mr. President, I was very much interested in Dr. Smith's explanation with regard to the prevalence of malaria where the soil has been freshly turned up, I shall be interested also to know his reasons for the great prevalence of malaria in the States to the south of us, and the comparative immunity of Massachusetts, or a great part of Massachusetts.

Dr. Smith.— Mr. President, as we go south, all parasitic diseases increase in intensity; and this is largely due to the fact that there is no cold winter to interrupt the life of the parasites in nature. The same is true of mosquitoes. Consequently, infected mosquitoes are able to do much more damage than they would in the North, where their breeding is interrupted every season when the winter comes. This is the great safeguard of temperate climates toward all forms of parasitic and malarial diseases.

Dr. Miller.— Did I understand Dr. Smith to say in his paper that lime thrown in these quiet pools would destroy the mosquitoes?

Dr. Smith.— Ordinary slaked lime will destroy them by producing an alkaline reaction of the water.

Dr. Chapin, Providence.— Mr. President, I have been very much interested and delighted with Dr. Smith's remarks, setting this matter of the malaria and the mosquito so clearly before us; and I hope he has succeeded in arousing an active interest on the part of every Board of Health. It seems to me he certainly must have by what he has told us this afternoon. I see no reason, except lack of funds, why every Board of Health or health officer should not undertake the investigation of the mosquito and the destruction of it. One remark that Dr. Smith made, I hope, will impress itself forcibly upon every one,— that it is a good plan to look first and see whether there are any mosquito larvæ present before we attempt to eradicate the breeding-places. It is necessary, it seems to me, before we go to work to fight the mosquito, to find where the mosquito is; and this can only be done by painstaking investigation of every possible breeding-place in town, and perhaps in adjoining towns, for I am afraid that we will find that in many instances the mosquito is borne a very considerable distance, perhaps over a mile, by prevailing winds. We have done a little of this work in Providence, and have found some surprising results. In many places where we expected to find

mosquitoes we found none; and in others, where we did not expect to find them, we did find them. We met with some difficult problems. It is easy to say you should either drain or fill up, or put on kerosene or stock with fish; but we found in Providence that the most fertile breeding-place for mosquitoes was a river which is so grossly polluted that fish will not live in it, but mosquitoes breed in great quantities. The river is so situated and is so rapid that, it seems to me, it would be extremely difficult, if not impossible, to apply kerosene; and I think there would be objection on the part of those who are the riparian owners. We cannot stock it with fish, because the fish will not live in it; and of course there is no way of draining it. At present the alternative seems to be to render it pure. As it is polluted by wealthy manufacturers, we expect to be troubled by mosquitoes for a long time to come.

Dr. Smith.— I should like to ask Dr. Chapin how the larvæ maintain themselves in the strong current of water. Why are they not all carried away?

Dr. Chapin, Providence.— They, of course, do not live where the current is rapid; but all along the stream there will be little recesses in the banks, and there are quite a number of dams, making mill ponds, and in these the mosquitoes breed in great numbers. The stream is so polluted at places with the discharge from a bleachery that it is easy to smell the chlorine at quite a distance from the banks. But no fish are there. We have never found in Providence any number of mosquitoes in a body of water where there were fish, except among plants along the margins where fish cannot swim. We will occasionally find a few struggling larvæ in ponds where there are fish, but no great number.

Dr. Smith.— I should like to ask Dr. Chapin again whether the water had been analyzed to find out what deleterious elements were present. That would give us some information as to the amount of deleterious and noxious substances that the mosquito larvæ can stand.

Dr. Chapin, Providence.— The water has been analyzed — I think it is analyzed monthly — from one or two points by the State Board of Health. I don't know what the analysis is or how complete it is, but they make some analysis of it. The subject of the

prevention of the pollution of the stream is under consideration now, and the analysis will undoubtedly receive further consideration. We found mosquitoes breeding in salt water in Providence, water that was extremely salt, very much salter than the water of the ocean,— pools left by high tides and which have evaporated by the sun; but in these, again, we don't find them where there are any fish. There is one marsh within the city limits that is traversed by ditches, and the ditches and pools connected with it all have fish, and there are no mosquito larvæ; but, wherever the cattle walk about in the marsh and make little depressions, these are all full of mosquito larvæ. The mosquitoes are the striped variety, I think.

Dr. B. F. Davenport.— Do I understand the gentleman to say that, when the water is so polluted with chloride of lime as to smell strongly of it, and to kill the fish, mosquitoes yet abound in it?

Dr. Chapin, Providence.— Yes, sir.

Dr. Davenport.— It is commonly supposed that chlorine would have a destructive effect upon all animal or vegetable life. We use it for disinfecting purposes with that idea.

Dr. Chapin, Providence.— I said we found some surprising things.

Dr. Durgin.— In connection with Dr. Chapin's remarks concerning the activity of members of the boards of health in this work, I would say that in Massachusetts every Board of Health has authority under Chapter 80 for putting into effect the so-called wet, rotten, and spongy land act. The Board of Health can proceed and drain it to its satisfaction and put a lien on the property for the expense, up to a limit of $2,000 in each instance.

Mr. Scott.— Mr. Chairman, perhaps some of the members of the Board of Health here present from the different towns will realize the predicament which Hyde Park is in. We have a space which is wet, rough, and spongy. We have already given a hearing, and we have declared the place a nuisance. We have asked the selectmen to insert an article in the warrant, giving us money,— it is going to cost more than $2,000, to the best of our knowledge and ability,— and the selectmen feel poor. They refuse to put the article in the warrant. We would like to do it, but we cannot do it. We have got to wait till later on. You will find that is the trouble in most towns.

Dr. Durgin.— Do half of it under one contract, and the rest under another contract.

Dr. Davenport.— Mr. Chairman, in the case of a Massachusetts town, if the gentleman would present a petition with the signatures of ten legal voters, the selectmen would have by the statutes to put the article into the warrant.

Mr. Scott.— I state, Mr. Chairman, we have the article, and we have another article at the same time, drawn up by a lawyer, with ten signatures, good legal citizens of the town, and they refused also to do that. I don't know what we can do really unless we do as Dr. Durgin says,— do half of it and then do the other half.

Dr. Durgin.— Do the next best thing at your next election.

Mr. Underwood.— I should like to ask Dr. Smith if it has been determined whether there is any particular time in the cycle of the organism in the human body that the mosquito must bite, in order to convey the organism to himself when he attacks a person who is afflicted with malaria. Will the organism go into his body at any time or must it be at some certain stage in the cycle of the development?

Dr. Smith.— I think that is not very well determined at present, but theoretically, at least, the conditions are these: that, unless the parasite is in the stage of producing the male and female elements, no transmission of the malarial parasite takes place. If it is simply in the stage of sporelation, it is fit to reinfect the individual himself, producing repetitions of the chill; but, when the stage has arrived for the parasite to go into the stages of male and female elements, then it can be taken into the stomach of the mosquito, because there these gametes are ready for fertilization and further development.

Dr. Hill.— Would it be a fair deduction from your statement, Dr. Smith, to say that a patient must be bitten during the chill in order to infect the mosquito?

Dr. Smith.— No, I think not, because the chill takes place when the ordinary sporelation, so called, within the body takes place, which tends to reinfect fresh corpuscles; but, when these bodies are formed, I do not know that we have any evidence that any chill occurs.

Dr. Hill.— Is it not taught that these sexual forms do not develop except outside of the body?

Dr. Smith.— The sexual forms do develop to a certain point before they leave the human body.

The President.— Is there anything else to be said upon this most interesting subject? In one respect only can I add anything to complete Dr. Smith's paper. The first demonstration of the real nature of the malarial disease of cattle — one of the most important discoveries in medicine of this generation — was the work of Dr. Smith himself.

Dr. Durgin.— I move that a vote of thanks of the Association be given to Dr. Smith for his most interesting and valuable paper.

Dr. Chase.— I second the motion.

The motion was adopted unanimously.

Dr. Durgin.— I hope that the remark of the President concerning the next place of meeting, in October, will not be forgotten, and that those who are anxious for meetings in some of the distant cities of the State will communicate with the officers of the Association before a great while.

The President.— Is there any further business to come before the Association at this time? If not, it is moved that we do now adjourn.

Adjourned.

JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH

October Meeting, 1901

SUBJECT: The Purification of Water by Freezing

Members Massachusetts Association of Boards of Health.

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Brighton.

Otis H. Marion, M.D.
Horace E. Marion, M.D.
F. W. Rice, M.D.
Henry G. Rowen, M.D.

Brockton.

Charles H. Cary.
F. J. Ripley, M.D.
F. Herbert Snow, C.E.
S. Alfred Spear.
R. S. Weston.

Brookline.

H. L. Chase, M.D.
James M. Codman, Jr.
Francis P. Denny, M.D.
J. Albert C. Nyken.
F. H. Osgood, M.R.C.V.S.
Wm. Rodman Peabody.
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John K. Whiting.

Cambridge.

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John Crawford.
E. A. Darling, M.D.
Edwin Farnham, M.D.
Charles Harris.
E. E. Spencer, M.D.
H. P. Walcott, M.D.

Charlestown.

C. H. Hood.

Chelsea.

H. A. Sibley, M.D.

Clinton.

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W. P. Bowers, M.D.
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J. J. Goodwin, M.D.
George L. Tobey, M.D.
John F. Worcester, M.D.

Cohasset.

Oliver H. Howe, M.D.

Concord.

John M. Keyes.
Thomas Todd.

Dedham.

E. W. Finn, M.D.

Duxbury.

N. K. Noyes, M.D.

Everett.

Alton A. Jackson, M.D.
N. B. Smith.
E. W. Young, M.D.
Geo. E. Whitehill, M.D.

Fall River.

A. W. Buck, M.D.
John Gilbert.
Charles A. Hicks, M.D.

Falmouth.

Russel S. Nye.
Asa R. Pattee.

Fitchburg.

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Henry M. Francis.
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Fred R. Houghton.
John D. Kielty, M.D.,
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Chas. H. Rice, M.D.
David W. Tinsley.
D. S. Woodworth, M.D.

Framingham.

N. I. Bowditch.

Gloucester.

H. L. Belden.

Greenfield.

H. G. Stetson, M.D.

Haverhill.

John F. Croston, M.D.

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JOURNAL OF THE

Massachusetts Association of Boards of Health.

ORGANIZED 1890.

[The Association as a body is not responsible for statements or opinions of any of its members.]

Vol. XI. December, 1901. No. 4.

OCTOBER MEETING

OF THE

Massachusetts Association of Boards of Health.

The October quarterly meeting of the Massachusetts Association of Boards of Health was held in Boston at the Parker House on the afternoon of Wednesday, October 23, Dr. Henry P. Walcott, the President, in the chair.

The President. — The Executive Committee recommends to the Association for membership in the Association Dr. Lyman F. Bigelow of the Norwood Board of Health. Is it your pleasure that he be elected a member of this Association?

Dr. Bigelow was elected to membership.

The President. — The Secretary will read the records of the last meeting of this Association.

Mr. James C. Coffey, the Secretary, read the records of the July meeting.

The President. — Is there any change to be made in the record that has been read to you? If not, it will stand as the record of the

last meeting of this Association. Mr. Clark will now read his paper upon "A Study of the Purification of Water by Freezing."

THE PURIFICATION OF WATER BY FREEZING.

The question of the purity of an ice supply harvested from a pond or river the water in which is more or less open to suspicion, owing to the entrance of drainage, is one that has given many persons much uneasiness of mind and many misgivings as to the desirability of using such ice. Thirteen years ago the legislature of Massachusetts directed the State Board of Health to make, in the words of the resolve, "a special investigation with reference to the pollution of ponds, lakes, streams, or other bodies of water used as ice supplies in this State, especially with reference to the effect of such pollution upon the healthfulness of such ice for domestic use." In accordance with this direction the board made an elaborate investigation, the results of which were published in the annual report for the year 1889. Circulars were sent out to every city and town in the State, to local boards of health, physicians, etc., and replies asked to four questions. One of these questions was, "Have any cases of illness come to your knowledge from the use of ice cut from such sources (that is, polluted sources)?" and it is noticeable that, in the one hundred eighty-nine replies received, the answer to this question was generally "No." A few cases, however, in the language of the board, "were noted where the ice supply was suspected to be the cause of illness; but none appeared to be so definitely connected with this cause as to give promise of additional knowledge, if investigated further."

The conclusions of that investigation of the board were, briefly stated, as follows: "Taking an average of all the water and ice used for ice supplies which we have examined, we find that the organic impurities of the snow ice as shown by the sum of the ammonias," in the words of the writer of the report, "amount to 69 per cent. of those of the waters, that the organic impurities of all the ice except the snow ice amount to 12 per cent. of those of the waters, and those of what we call clear ice amount to 6 per cent. of the impu-

rities of the waters. There were 81 per cent. as many bacteria in the snow ice as in the waters, 10 per cent. as many in all other ice, and 2 per cent. as many in the clear ice as in the waters. The results obtained lead to the conclusions that, while clear ice from polluted sources may contain so small a percentage of the impurities of the source that it may not be regarded as injurious to health, the snow ice and any ice, however clear, that may have been formed by flooding, is likely to contain so large a percentage of the impurities of the source, and with these impurities some of the disease germs that may be in the source, that the board feels bound to warn the public against using ice for domestic purposes which is obtained from a source polluted by sewage beyond that which would be allowable in a drinking water, and placing in contact with food that portion of the ice which is clear." In that investigation all the analyses made were of samples of water and of ice collected from the various places in the State named in the report.

This work followed quickly after that of Dr. T. Mitchell Prudden, published in the *Medical Record*, vol. 31; and the conclusions reached in regard to the variation in the quality of ice from different portions of the same cake were practically identical. But Dr. Prudden's investigations were entirely with the ice of the Hudson River, while the board's investigations, with nearly three hundred analyses of samples of ice and water, covered a large number of different supplies of both water and ice.

In the thirteen years that have elapsed since that report was made, methods of bacterial analysis have improved somewhat; and during the past two winters we have been making a second investigation in regard to the purification of water by freezing, in order to gain additional knowledge upon some points that are evidently of importance, if questions in regard to ice formed under widely differing conditions are to be always intelligently answered. In this investigation more attention has been paid to the examination of ice formed in tanks in water polluted to degrees which we more or less controlled, although quite a number of samples of ice, together with samples of water, have been taken from rivers and ponds known to be polluted and from which ice supplies are sold for domestic use.

It is evident that the chemical and bacterial examination of a cake

of ice shipped to a laboratory, while satisfactory to the analyst as showing with considerable definiteness the character of this particular cake, has seemed to mean but little at times, when considering the ice supply as a whole from which the cake was taken and the method in which it was harvested. A report from the analyst, therefore, showing this cake to be of an entirely satisfactory quality, and, therefore, the ice safe to use, is often exactly opposed to the opinion of the collector of the cake, who has examined the source of the ice supply in question, and detected numerous chances of pollution, even though this collector may know perfectly well that bacterial and chemical purification of water occurs during freezing. Just how great this purification is, under the varying conditions that must obtain in different ponds and rivers containing water of a varying quality, has not, of course, been definitely known to us, even after the thorough investigation referred to. It was hoped, therefore, that by this second investigation we should determine this point as nearly as possible. Besides this, we have not known as well as could be desired the difference in purification that occurs with ice formed in quiet water compared with ice formed in water moving with different degrees of rapidity; and in regard to this we also hoped to gain information, as river ice is, of course, largely used in some places. The effect of the depth of the water in which the ice is formed, in regard to the purification occurring, was also a point upon which more definite information was desired.

During the winter of 1900–1901 we made some investigations in regard to the retention of bacteria in ice during the freezing of water, and the length of life of these bacteria under these conditions; and during last winter the investigations were continued. In the first work the experiments were so conducted that all the water placed in a pail or small tank was frozen, this, of course, not being the manner in which ice is formed upon most of our natural ice supplies, although much of the ice from artificial ice plants is formed in this way, this ice, however, being generally formed from what is supposed to be very pure natural water and often distilled water. It can be stated, however, that we have found many instances in the State where villages or sections of towns are supplied with ice harvested from ponds of so shallow a depth of water that practically all the

water is frozen, and in these instances the ice resembles more or less closely the ice formed in these first experiments.

In these experiments we used a polluted river water and also sewage, and found, as was expected, that, when freezing all of the water in a receptacle, a very large proportion of the bacteria in the water frozen was killed in the process of freezing, but still a very large number was left in the ice and lived for a number of weeks. It was found, also, in freezing water in this way that the outer portion of the water, not only that on the surface, but also that around the outside of the pail, was the first to be frozen, and that this caused the bacteria to be so driven toward the centre of the water in the pail that the ice that was formed last — that is, in the centre — would contain the greater number of bacteria. For instance, in one experiment, where the water used contained 2,600 bacteria per cubic centimetre and 115 B. coli, the outer ice of the cake contained only from 100 to 600 bacteria per cubic centimetre with no coli present, while the ice formed in the centre of the cake contained, when examined even at a considerably later date, from 5,000 to 20,000 bacteria per cubic centimetre. I have mentioned the number of B. coli here; and, in all of our work, not only was the number of all bacteria in the water and ice determined, but also as nearly as possible the number of the colon bacillus present, this being the characteristic organism of sewage.

In another instance, when carrying on an experiment of this nature, where the liquid frozen in the tank was sewage, this sewage before freezing contained 1,500,000 bacteria per cubic centimetre; the ice first formed — that is, the outside of the cake — contained 74,000 bacteria per cubic centimetre; the ice toward the centre of the cake, 121,000 bacteria per cubic centimetre; and the unfrozen sewage in the centre of the cake, 640,000 bacteria per cubic centimetre. The same relation held true with the coli present in the water and the ice; that is, 320,000 coli per cubic centimetre in the sewage before freezing, 7,000 in the outside ice of the cake, 9,000 in the inside ice, and 52,000 in the unfrozen sewage in the centre of the cake. Many other experiments of this character were made, all showing what these two experiments that I have described illustrated; that is, that in freezing a solid block of ice a very great number of bacteria were retained within this ice, and that these bacteria would

live for a number of weeks. In these experiments upon freezing the entire volume of water, the best bacterial purification shown by freezing was 85 per cent.; that is, 85 per cent. of the bacteria in the sewage or water were not found in the best portions of the ice formed, but generally the bacterial purification was very much less than this.

The further investigations made were in regard to the points previously mentioned: the purification both bacterially and chemically of ice formed on different depths of water, water polluted to different degrees, and water polluted to equal degrees, but moving with different degrees of rapidity.

The results in regard to the different degrees of purity obtained when waters were frozen in receptacles containing different depths of the liquid averaged as follows: with one foot in depth and with the ice formed occupying more than one-third of this depth, we obtained, when freezing, a water containing 7,100 bacteria per cubic centimetre, an ice containing 560 bacteria per cubic centimetre, or a bacterial purification of 92 per cent. This water before freezing contained 17 B. coli per cubic centimetre; but the ice formed was free from this organism, as far as our examinations could determine. Freezing a more polluted water, or perhaps I should call it sewage, in a tank of this depth, this sewage containing 500,000 bacteria per cubic centimetre, we obtained an ice containing 3,000 bacteria per cubic centimetre, or a bacterial purification of 99 per cent.,— a large percentage removal, but still a very large number of bacteria caught in the ice.

During the winter of 1900–1901 the investigation was continued, and very many experiments were made, in which volumes of water of varying degrees of purity were exposed in tanks 6 feet deep and 28 inches in diameter; and the ice formed upon these tanks was carefully examined. In all of this experimental work it was found that from 95 to 99 per cent. of the total numbers of bacteria in the waters experimented with were eliminated from the water during freezing, and that, whenever a water not more polluted than the Merrimack River water at Lawrence, into which, however, the unpurified sewage of a number of cities flows, was frozen in these tanks, every colony of the colon bacillus was killed or excluded from the ice formed, judging from our examinations. That is, the bacterial purification by freezing that occurred in these deeper tanks was much greater than occurred in the

shallower depth of water already described. When, however, we increased the pollution of the river water by adding 5 per cent. by volume of sewage, so that the number of B. coli present was made about five times as great, the ice formed contained this germ, together with a greatly increased number of other bacteria.

Besides these experiments in the tanks, a number of samples of ice for chemical and bacterial examination were taken as it formed upon running water, such as the polluted Merrimack River, and from still water, also polluted to a greater or less extent, samples of water being collected also wherever samples of ice were collected. Twice during the winter a series of samples of ice and water was collected from the river at different points above Lawrence and between Lawrence and Lowell, and examined both chemically and bacterially, these samples being collected at distances varying from three to eight and one-half miles below the outlets of the sewers of Lowell, Lowell being a city of 90,000 inhabitants, and emptying all of its sewage into the river. Examination of all these ice samples showed that, while the average number of bacteria in the river water, collected at the same locations from which our ice samples were taken, was 4,100 per cubic centimetre, the average number of bacteria in the ice was 9 per cubic centimetre, showing an elimination of 99.78 per cent. The average number of B. coli in the river water was 120 per cubic centimetre, and this germ was not found in any of the ice samples examined. That is to say, the number of bacteria found in this ice formed upon the river was less than the number in the ice formed from the same river water in our experimental tanks. While this was partly due to the greater depth of water in the river than in our tanks, still the river ice had been formed for a number of weeks before collection and examination, while the tank ice was examined generally within a few hours of forming. This second difference probably accounts very largely for whatever difference there was in number of bacteria found, as the river ice had been formed long enough for many bacteria, at first retained in it, to die. The chemical results of this examination of the river ice showed an elimination of organic impurities as follows : —

PERCENTAGE ELIMINATION.

1901.	Color.	Ammonia.			Chlorine.	Nitrogen as		Oxygen consumed.	Hardness.	Bacteria per cubic centimetre.	B. coli per cubic centimetre.
		Free.	Albuminoid.			Nitrates.	Nitrites.				
			Total.	In solution.							
Jan. 22	86.5	50.6	64.3	70.3	93.1	76.2	—	77.8	88.9	{ 99.7 99.9	100.0
Feb. 20, top of cake .	72.2	40.3	44.1	—	85.7	80.0	—	44.2	91.7	99.2	100.0
Bottom of cake	86.1	86.1	74.6	—	100.0	92.0	—	86.0	100.0	99.9	100.0
Average . .	83.3	71.6	61.0	—	92.9	92.0	00.0	74.4	91.7	99.6	100.0

There is, moreover, at Lawrence a large water power and canals by which the river water is distributed to the various mills. In these canals the water is flowing at a much greater rapidity than the water in the river, and twenty-two samples of ice formed upon this swiftly moving river water were collected during the past winter and also examined for the presence of bacteria. It was noticed that the elimination of total numbers of bacteria in the ice formed under these conditions from the same river water was not nearly as great as in ice formed under the conditions in the river, where the water is moving much more slowly, and about 35 per cent. of the samples of ice collected from the canal that were examined contained colonies of the colon bacillus.

A large number of samples of ice and water from other ponds and rivers upon which the ice was formed under varying conditions of quietude or depth and degree of pollution were obtained, and in general the same results were found as in our experiments with water frozen under different conditions in our tanks and with the ice and water collected from the Merrimack River.

Summarizing, we can say that the power water has of purifying itself by its transformation into crystals of ice is well known, and is characteristic of crystallization. Studying the chemical analyses that we have made of samples of water and the ice formed from similar water, we find that not only is a considerable percentage of the bodies

in suspension in the water prevented from becoming embodied in the ice crystals formed, but also, what at first glance appears more remarkable, a larger percentage of the bodies in solution is thus prevented. Free ammonia, chlorides, and the mineral salts that cause hardness are all partially or entirely driven from the water frozen into the water remaining unfrozen. That a greater percentage of the mineral salts in solution is removed than of free ammonia is, perhaps, due to the greater density of the first bodies when in solution, and hence the greater ease with which they are driven out. Furthermore, it is evident that a substance such as ice, which in forming can free itself from the bodies in solution, must have a considerable power to prevent bacteria — that is, bodies of a tangible size and in suspension — from becoming entangled with it, particularly, as our experiments have shown, if there is a considerable depth of water under the ice forming, and if these bacteria do not have a tendency to rise. That bacteria do not have this tendency is, I think, a well-proved fact.

We found that not in one instance of the still freezing of ordinarily polluted water in our tanks, or still water in the ponds examined, were we able to find B. coli in the ice formed. When freezing Merrimack River water in tanks, the average number of bacteria of all kinds retained in the ice has been considerably less than 2 per cent. of the number in the water, and is a number averaging nearly as low as the average number we could expect in the effluent of a sand filter doing satisfactory work, and to which Merrimack River water was applied.

When freezing sewage in our tanks, or Merrimack River water made more polluted by the addition of 5 per cent. by volume of sewage, B. coli, together with a large number of other bacteria, has been retained in the ice formed; that is, here we have exceeded the limits of the bacterial and organic pollution which the ice, as it forms from the water and crystallizes, can overcome. When ice is formed in swiftly running water as polluted as that in the Merrimack River, where sedimentation is overcome to a certain extent, and there is a constant lateral or rolling movement of all the matter in suspension in the water, together with a tendency to prevent perfect crystallization because of this rolling movement, the danger of the retention of

bacteria in the ice is much greater, as shown by the canal ice results. This ice was but just formed, however, at the time of examination, while the ice from the river which was examined had been formed for perhaps several weeks, and hence time enough had elapsed for many bacteria to die.

In none of the fourteen samples, however, of ice collected by us that had formed upon the comparatively slowly moving river water between Lawrence and Lowell, did we find B. coli, and the bacterial efficiency of freezing, as shown by these samples, even including the bacteria in the top ice of each cake, was 99.78 per cent.; that is, the ice contained only 22 per cent. of the number of bacteria in the water from which it was formed.

It is evident, from all our experiments, that, if the ice formed is not to contain any considerable number of bacteria of any kind, it must be formed in such a place that all of the water is not frozen; and, the deeper and quieter the water under the layer of ice when forming, the less is the chance of bacteria being retained in the ice, this applying to ice formed upon both rivers and ponds. When, in order to thicken ice, the ice already formed on a pond or river is flooded and the entire volume of water over the ice is frozen, bacteria will undoubtedly be retained in this ice just the same as when the total volume of water in our pails was frozen, this point being distinctly brought out by the investigation and report of the board upon this subject in the year 1889. It is also evident that the point then made, that the top ice should be planed and removed before cutting and storing, is of value, not only on account of intentional flooding and of accidental flooding by a weight of snow on the ice, but also as there is a chance of many bacteria being frozen into the top ice at times of high wind when the first ice is forming, that is, the wind may stir the water to a considerable depth, overcoming sedimentation and the usual elimination of bacteria, and the water may wash over the ice as it forms.

On the whole, it is evident that the conditions surrounding water when it freezes are very important factors in determining the purity of the ice formed. If there is a considerable depth of water in portions of a somewhat polluted pond or river, and the ice is formed in these portions in comparatively quiet water, with but little matter in

suspension, this ice will probably be entirely satisfactory for domestic use, although a considerable drainage may enter the body of water upon which it forms. On the other hand, ice formed in shallow portions of such ponds or rivers, even during still weather, or in any portion, if there is a considerable movement of the water by currents or wind while it is forming, may be rendered by these conditions entirely unfit for domestic use. The instances, however, where the pollution of an ice supply are known to have caused disease are exceedingly rare. Lawrence is supplied very largely with ice cut from the Merrimack River; and yet, since the construction of the city filter, the typhoid death-rate of the city has been very low, owing to the excellent quality of the city water. In former years, moreover, the epidemics of typhoid fever occurred during the winter rather than in summer, when the consumption of ice is greatest.

THE PRESIDENT.—Mr. Clark's paper is before the Association for discussion; and the Association will be glad now to hear from Mr. Winslow, who, I understand, has something to say upon the subject.

Mr. WINSLOW.—I have been very much interested in Mr. Clark's valuable paper, because Professor Sedgwick and I did considerable work on this problem of the life of bacteria in ice, and especially the typhoid fever germ in 1898 and 1899. I am sorry that Professor Sedgwick is not here to discuss the paper himself, but he is unavoidably absent at the Yale Bi-centennial. He wished me to appear and say a word or two about our results, which have not yet been published in full, though they have been published in abstract. The full report has been delayed, but will be published, I hope, very soon.

It was generally assumed, I think, a few years ago that ice might be, and indeed was, a common source of infection in typhoid fever. Search through the literature, however, showed that the evidence from epidemiology was almost nothing, and that from experiment was very slight, indeed. We were unable to find a single instance of typhoid fever being definitely traced to ice supply. And, of all the numerous experiments carried out to determine the effect of cold on the typhoid germ, all but those of one observer were rendered practically insignificant because they were not quantitative. It was

clearly shown by many experimenters that, if typhoid fever germs in broth and agar cultures were frozen, sterilization did not ensue; but, as to the proportion of bacteria remaining alive in water after freezing, there was no evidence except in three experiments made by Dr. T. M. Prudden, of New York. (*Medical Record*, March 26, 1887.) One experiment showed a reduction of 80 per cent. in eight days, and another of nearly 95 per cent. in five days. In the third case the bacteria present in the water originally were innumerable, so that those results are not quantitative. On the strength of these results, from three experiments only with the typhoid germ, Dr. Prudden concluded the danger from infected ice was a very serious one. These three experiments, and one reported by Mr. Hiram F. Mills, in which typhoid germs died out in chilled water in 25 days (Rep. Mass. S. H. B. 1890, p. 542) furnished the only available data as to the quantitative reduction of typhoid fever bacteria effected by cold.

In our work, test-tubes of sterilized tap water were inoculated with pure cultures of the typhoid germ; and the attempt was made to secure significant results by the averaging of twenty tubes thus inoculated for each set of conditions. Four stock cultures were used; and it was found that the resistance of the four stocks, or "physiological races," as they may be considered, varied materially and rather constantly. The general results of these experiments for various periods of time are shown on the chart. This chart shows the results, the percentage reduction; that is, the percentage killed by freezing in the times indicated in the column on the left, for these four races, or four stock cultures. It begins with fifteen minutes, and each figure represents the averaging of twenty tubes. It will be noted that after two weeks an average of over 99 per cent. of the germs had perished in each case. During the first half-hour of the freezing a heavy but variable reduction took place. Sometimes 60 per cent. would be killed in one tube, and only 30 per cent. in the tube next it, for some reasons that we were unable to determine, possibly on account of the amount of culture medium or the physical conditions of freezing. At any rate, the conditions were very variable during the first half-hour. From this time on to about two weeks the reduction increased with the time,— the longer the tubes were frozen, the greater was the percentage reduction,— and

that increase was rapid during the first twenty-four hours, and then slower after that time. As I say, in two weeks in each case over 99 per cent. of the germs were killed. The two or three germs per thousand which survived the first two weeks appeared, however, to be specially resistant, and a considerable number of the tubes were not rendered sterile, even after twelve weeks; that is, a very few, two or three out of a thousand, remained alive. This, of course, explains the result of the previous observers, who froze up culture tubes containing millions and millions of germs, and found they were not sterilized. Alternate freezing and thawing appeared in our work, as in Dr. Prudden's, to be somewhat more effectual than continuous freezing, although even this process rarely brought about entire sterilization. The destruction of the germs in cool but unfrozen water followed very much the same laws as in the ice, and the percentage reduction of the germs was only slightly less in the water cooled down just above freezing. In water cooled almost to freezing the reduction was only a little less than it was in the ice. So that it appears that the mechanical effect of crystallization does not play any important part, as it was supposed it did. The reduction in individual tubes varied, however, much more widely in the water than in the ice, though the general percentage was nearly as great. There were a few individual tubes which did not show a marked reduction, whereas in the ice after twenty-four hours the results were quite constant. A few experiments on the behavior of typhoid bacilli when mixed with sterilized earth showed that in dry earth they died out, very rapidly at first and then more slowly, the progress again stopping short of sterilization. Temperature did not affect the results very seriously, but dampness was quite important. Finally, to test the effect of the purely physical purification effected by crystallization alone, we allowed ice to form freely on the surface of typhoid-infected water in a wine cask, and found that the ice contained only about 10 per cent. of the bacteria present in the water just below.

In summing up these results in a paper read before the American Academy of Arts and Sciences in December, 1899, our conclusions were given as follows: —

"The conditions which tend naturally to purify polluted waters are

well understood. Light, cold, and poor food supply are antiseptic agents of considerable power. . . . The main factor determining the reduction of germs in water is, however, the *time,*— the time during which these other forces are left to act. Epidemiology shows clearly that disease follows a direct, quick transfer of infectious material from patient to susceptible victim; and, if storage of water for some months could be insured, most sanitarians would consider that a sufficient purification.

"In ice we have this condition realized,— a forced storage of at least weeks and at best of many months. At the same time the other deleterious conditions are also heightened. The temperature is severe; and, while the ice remains upon the pond, the action of light must be intensified. It is no wonder, then, that our experiments show a reduction of over 99 per cent. in frozen typhoid bacilli; and we may be sure that in nature the destruction would exceed rather than fall short of such a limit.

"This reduction obtains in tubes which are frozen solid, where there is no chance for mechanical exclusion. In natural ice there is another purifying influence. Of the germs remaining in the water at the time of freezing, 90 per cent. are thrown out by the physical nature of that process. This reduction is separate from, and supplementary to, the antiseptic action of the cold. Therefore, when both factors work together, only one out of a thousand typhoid germs present in a polluted stream has a chance of surviving in the ice.

"Under natural conditions the pathogenic germs present in the most highly polluted stream are few in number. Of these few, one-tenth of one per cent. may be present in ice derived therefrom. These scattered individuals are weakened by their sojourn under unfavorable conditions, so that, as we have seen, they require nearly twice as long for their development as do the normal germs."

(We noticed in our experiments that the cultures made from the frozen water developed much more slowly in the artificial media than did those that were not so treated.)

"Evidently, those few and weakened germs cannot produce many cases of typhoid fever. . . .

"As long as absolute sterilization is not effected, there must always remain a certain element of doubt, as in the use of sand filters,

alluded to above, or in the practice of room disinfection after contagious diseases. The thickness of a layer of ice is often artificially increased by cutting holes in it and flooding that already formed with the water of the pond. In such a case the effects of crystallization are excluded, as in the laboratory tubes. Ice thus formed might be cut at once, and served within a week or two; and in such an exceptional case we cannot say that sufficient of the virus might not persist to excite the malady. Yet such an instance must be most exceptional; and the general result of human experience, the absence of epidemics of typhoid fever traced conclusively to ice, the fact that cities like New York, and Lowell and Lawrence in this State, use habitually the ice of polluted streams, and yet maintain low death-rates from typhoid fever, all tend to support the conclusion at which we have arrived,— that ice can very rarely be a vehicle of typhoid fever."

These conclusions, presented, as I have said, to the American Academy and in abstract at the first meeting of the Society of American Bacteriologists, Dec. 29, 1899, were, I think, received with some surprise, if not with some incredulity. In the following spring, however, Dr. W. H. Park read a paper before the Boston Society of Medical Science) *Journ. Bost. Soc. Med. Sci.* iv. 213), in which he noted the percentage reduction in samples of ice formed from water inoculated with twenty different cultures of typhoid bacilli. Nineteen cultures behaved as did those which Professor Sedgwick and I have used. One was more resistent, for the whole twenty cultures bringing the total average number surviving up to 7.5 per cent. after two weeks and .4 per cent. after three weeks. Dr. Park's results thus coincided in general with our own.

Dr. H. W. Hill, in a special report made to the Boston Board of Health only six weeks ago, after reviewing all the evidence, used the following telling illustration: "Beginning with a certain number of bacilli in the ice after three weeks, the percentage is the same as the percentage purification achieved in the city of Lawrence filter, and equivalent to the bacterial efficiency of 99.5 per cent. Hence water known to be infected with typhoid bacilli might, after standing three weeks from the date of freezing, be consumed with no more danger than that involved in drinking infected water after efficient filtration."

And now Mr. Clark, with his interesting and valuable experiments upon infected waters, sewage, etc., confirms our conclusion derived from experiments upon typhoid and B. coli.

It is undoubtedly true that typhoid fever may conceivably be carried by ice. If fæcal matter or sewage were frozen solidly into a mass of ice, say by flooding of the surface of ice already formed, the results of the various experiments would scarcely apply. Dr. Park showed that typhoid bacilli in fæces did not appear to be very greatly affected by cold, and our earth experiments led to the same conclusion. The great Plymouth epidemic caused by fæcal matter thrown out on the snow may come under this head. At the same time it appears to be a fact that ice formed under any ordinary conditions, even on waters so polluted as to be unfit for drinking, is likely to be so purified as not to be an important source of infection, though it is theoretically worthy of consideration.

PERCENTAGE REDUCTION OF TYPHOID BACILLI IN ICE.

			Races	
Time frozen.	*A.*	*B.*	*C.*	*D.*
15 minutes	59.4	13.8		
30 "	63.7			
90 "	—	32.2		
2 hours	73.6			
3 "	—	41.4	99.5	74.8
6 "	83.3	—	—	97.0
12 "	—	38.6	—	84.4
15 "	—	—	89.0	
24 "	—	53.8	82.7	99.0
3 days	—	98.4	99.9	
7 "	—	93.3	99.5	
2 weeks	99.8	99.4	99.9	
4 "	99.8			
8 "	99.8			
12 "	99.8			

PERCENTAGE REDUCTION OF TYPHOID BACILLI IN WATER.

	Race D.			
Temperature.		*Time.*		
	3 hours.	*6 hours.*	*12 hours.*	*24 hours.*
20°	70.8	72.6	85.7	88.4
10°	63.1	74.0	87.4	95.5

Dr. Hill.— Mr. Winslow has very gracefully quoted part of my report; but it is only fair to say that that report itself was based in part on his work and that of Dr. Park, Dr. Clark's work not having appeared at that time.

I should like to ask Mr. Clark in regard to a certain standard which has been prescribed by various cities, Cleveland, Ohio, among them, for the chemical analysis of ice. They prescribe in their regulations that ice shall not yield certain amounts of ammonia, chlorine, etc., under penalty of being excluded from the market. I have supplied Mr. Clark with the figures; and I should like to ask him to comment upon them as proper standards for boards of health to adopt, or as improper standards.

Mr. Clark.— I think that it is probably more logical to adopt a standard of purity for ice than for waters; that is, that ice used or sold shall not contain over so much nitrogen or so many bacteria. It is more logical, I repeat, to adopt a standard of that sort for ice than for water, because you can certainly take even sewage and freeze it under such conditions that you will get a very fair quality of ice; while waters, of course, vary from natural conditions, geological, etc., in different parts of the country, and a standard for one part is not at all applicable to another part. Looking over this standard handed me by Dr. Hill that, I believe, is the standard of the boards of health of the cities that Dr. Hill has mentioned, I don't think that it is severe at all, because, as I have said, you certainly can take a pretty fair sample of sewage and freeze it, and still not have any more organic matter in the ice produced than is allowed by this standard. Of course, also, it is all right to say that the ice shall not contain any pathogenic organisms, nor more than 100 bacteria per cubic centimetre. I don't believe that good ice ever does contain more than 100 bacteria per cubic centimetre, and it certainly should not contain any pathogenic organisms.

The President.— Cannot you help us in the discussion, Dr. Chapin? You have had some Rhode Island experience in this matter.

Dr. Chapin, of Providence.—Mr. President, I certainly cannot add anything to what Mr. Clark has said, and Mr. Winslow, and Dr. Hill. They have the expert knowledge, and they have made the

experiments; and they know whereof they are talking. But I can say that I thank Mr. Clark and these other gentlemen that we can now drink all the ice water that we want to, and I hope those finicky people who feel obliged to cool their spring water in bottles set on the ice will now drink their ice water from the ice pitcher. While I feel duly grateful for these assurances of the wholesomeness of ice, yet I feel that that is only one of the minor points of value in Mr. Clark's paper. It is the character of the paper, and the investigation as a whole, of which I wish to speak. It is just exactly the kind of a paper that we would expect from Mr. Clark, and the kind of an investigation that we would expect to be undertaken by the Massachusetts State Board of Health. In our investigations of sanitary problems, I think in almost every case we should let the two sorts of investigation go hand in hand, what might be called the clinical studies and the laboratory studies; and that has been done in this problem. I feel that in the past, too often, our sanitary problems have been solved in somewhat this way: Some enthusiast, from a superficial investigation, or as a result of his own enthusiasm, has made certain dogmatic statements about the danger of certain things, such as typhoid in ice, or in oysters, or in celery, or dangers from sewer gas, or from something else; and he has published his statements perhaps in the medical journals. They have been read by health officers and by practising physicians, they have sunk deep into their hearts, they have talked about them, the public has read them, the reporters have added a touch or two, and, finally, we have got a great excitement about these questions. Then the city council or the board of health or the legislature are approached, perhaps, by interested parties; and we have elaborate laws upon the statute books forbidding the sale of certain kinds of ice, or of oysters grown in sewage, contaminated water, or of milk containing over a certain number of bacteria, or other regulations of that kind.

That is not the way to attack these problems. We should attack them in just exactly the way the Massachusetts State Board of Health attacks them. In investigating this ice question, they investigated first the clinical side of it; and they found, so far as they could learn,— and they have looked into the matter very carefully,— that disease has not been caused by the use of ice. Typhoid fever

epidemics have never been traced to ice. I would say that that is a point that I have had in mind in Providence for the last sixteen years. The kind of ice used by every typhoid case has been noted, and no outbreak of fever has ever been traced to ice. That is one side of the question. The evidence is here all on one side. There is no clinical evidence of danger in the use of ice as ordinarily put upon the market. But I do not believe that it is wise to trust to the clinical evidence alone, when we have laboratory methods of investigating the problem. These methods were employed by Mr. Clark, by Mr. Winslow, and by Dr. Hill; and they support the clinical evidence. They show very conclusively the reasons why there is no danger in drinking ice water, although the ice may be cut from rivers or ponds whose water would be somewhat dangerous to drink. The methods of investigation are the right methods; and they should be applied not only to this question, but to a dozen other questions, some of which I have named, and others which you will all think of. I hope that it will be the policy for this Association to apply such methods before they place themselves upon record as expressing their opinion upon any of these mooted points. [Applause.]

Dr. Hill.— It may interest the Association, possibly, to know in connection with what Dr. Chapin has been saying — although I don't know that he knows this particular fact — that interested parties have been making the statement of late that 29 per cent. of typhoid comes purely from natural ice. It is needless to say that the members of Boards of Health all over the country would welcome such a thing if it could be established as a fact, because the abolition of a natural ice supply then would do away with 29 per cent. of the typhoid. That statement is being made quite freely. I have heard that even from 40 to 60 per cent. of typhoid has been said to be due to natural ice. Of course, we can see exactly where such a statement stands in the face of what we have heard here.

Dr. French.— Mr. President, it occurred to me, while Dr. Chapin was thanking the Massachusetts Board of Health that he might be able to drink his ice water without any fear of typhoid; that we might be able to thank the gentleman that we could hereafter eat our Providence River oysters and lie down to pleasant dreams.

The President.—Mr. Underwood, hasn't this matter interested you?

Mr. UNDERWOOD.— Very much; but I don't think that I have anything to add to it, thank you.

The PRESIDENT.—The Association honored itself at its last meeting by electing to membership Professor Wesbrook of the University of Minnesota, and Professor Wesbrook sends the following note to the Secretary of the Association: —

Sir,— In acknowledging your letter of the 12th inst., I wish to express my appreciation of the honor the Massachusetts Association of Boards of Health has done me in electing me an honorary member.

I take great pleasure in accepting the membership tendered, and shall ask you to convey to the Association my thanks for the honor done me. I shall hope at some time in the future to have the privilege of attending some of your meetings.

Is there anything else to be said upon this subject of ice? If not, the Association is ready for any miscellaneous business that any member may care to bring before it.

Dr. HILL.—As the chairman of the Committee on Diphtheria is otherwise occupied for a moment, perhaps he will allow me to say unofficially that we have had returns from eight or ten places which promised to send us cultures on the subject of diphtheria bacilli in well persons. The total number of well persons examined to date, records of which have been sent us, is a little over four thousand, representing about eight thousand cultures; and we expect fully to get two thousand persons more, so that we will have finally six thousand persons, or twelve thousand cultures. The results have been tabulated partially, so far as they have been received; but it is an enormous piece of work to tabulate them, and I am afraid we shall not be able to report finally until the next meeting.

Mr. MARBLE.— Mr. President, I should like to inquire if any one present can give me any information as to the effectiveness of formaldehyde candles for fumigating purposes.

The PRESIDENT.— The Association has heard the question. Can you answer it, Mr. Clark? I am sorry to say that no member of the Association seems to have the necessary information.

Dr. HILL.— I might say that, although we have not personally experimented with them, we had occasion to look up what had been done in that line, and concluded that, if you used enough of the candles, you would get a disinfection from them just as well as from any

other form of formaldehyde. It is all a matter of getting enough gas into the room, and getting it in quickly; and you can get it from pastilles or from candles, and in many different methods, if you use enough of the reagent. Just how much to use is the great question. In Buffalo they made an investigation of the candles, the formaldehyde pulverized being mixed with paraffine; and they reported that they could disinfect in that way. They had to use more than the amount specified by the people who put it on the market, which is the usual experience with all disinfectants of this character. The Buffalo work is given in the December, 1900, monthly report of the Board of Health of Buffalo.

The PRESIDENT.— Dr. Davenport, have you had any experience in this matter?

Dr. B. F. DAVENPORT.— I have had no experience. I simply felt interested in the subject, and therefore consulted Dr. Durgin to learn if he knew anything about it. I thought, if they had any merit, he would be likely to know of it.

The PRESIDENT.— Dr. Tobey moves that we now adjourn.

Adjourned.

Hingham.

Chas. H. Marble.

Holyoke.

J. J. Linehan.
Arthur B. Wetherell, M.D.
Frank A. Woods, M.D.

Hyde Park.

Willard S. Everett, M.D.
Edwin C. Farwell.
William W. Scott.
Charles F. Stack, M.D.

Lancaster.

Chester C. Beckley, M.D.
Allen G. Butterick.
Albert E. Harriman.
F. A. Willard.

Lawrence.

Charles E. Birtwell.
A. D. V. Bourget.
George S. Fuller, D.V.S.
F. W. Kennedy, M.D.
George W. Smith.
Emil C. Stiegler.
J. F. Winchester, M.D.

Leominster.

C. E. Bigelow, M.D.
H. N. Spring.
A. L. Whitney.

Lexington.

George O. Whiting.

Lowell.

James B. Field, M.D.
J. Arthur Gage, M.D.
Thomas F. Harrington, M.D.
H. H. Knapp.
W. P. Lawler, M.D.
J. N. Marston, M.D.
Thomas B. Smith, M.D.

Malden.

Frank H. Parker, M.D.

Marlboro.

F. F. McCarthy, M.D.
William S. Richardson, M.D.

Melrose.

William H. Dole.
Clarence P. Holden, M.D.
Paul H. Provandie, M.D.

Milton.

Thomas K. Cummings.
Walter C. Kite, M.D.
Charles S. Minot, M.D.
Samuel D. Parker.

Needham.

A. E. Miller, M.D.
A. M. Miller, M.D.

New Bedford.

J. T. Bullard, M.D.
Thomas W Cook.
Edgar H. Gammons.
W. S. Kirschbaum.
Louis H. Richardson.
Manual V. Sylvia, M.D.

Newton.

J. C. Brimblecom.
Francis G. Curtis, M.D.
George H. Ellis.
W. F. Harbach.
Arthur Hudson
A. Stanton Hudson, M.D.
Henry A. Stone.
E. R. Utley, M.D.

New York City.

Col. W. F. Morse.

North Andover.

Charles P. Morrill, M.D.

North Brookfield.

T. J. Garrigan, M.D.

Norwood.

Lyman F. Bigelow, M.D.
Eben C. Norton, M.D.

Palmer.

J. P. Schneider, M.D.

Plymouth.

W. G. Brown, M.D.

Providence, R.I.

Ernest T. Badger.
C. V. Chapin, M.D.
F. P. Gorham, M.D.
Gardner T. Swarts, M.D.

Rockland.

J. C. Batchelder, M.D.
Gilman Osgood, M.D.

Salem.

G. Lincoln Allen.
C. A. Ahearne, M.D.
G. Arthur Bodwell.
Charles B. Fowler.
W. H. Gove.
Morgan McSweeney.
Raymond L. Newcomb.
William O. Safford.
A. N. Sargent, M.D.
David P. Waters.

Somerville.

Robert Burns.
W. H. Hitchings, V.S.
A. E. Merrill, M.D.
A. R Perry, M.D.

South Framingham.

L. M. Palmer, M.D.
W. N. Sharp, M.D.

Springfield.

A. L. Brown, M.D.
W. H. Chapin, M.D.
Herbert C. Emerson, M.D.
James Kimball.
B. D. Pierce, D.V.S.
J. C. Rausehousen.
S. J. Russell, M.D.

Taunton.

W. Y. Fox, M.D.
Charles H. Macomber.
T. J Robinson, M.D.
Edward J. Shannahan, M.D.
Elliott Washburn, M.D.
Henry H. Wilcox.

Turner's Falls.

P. F. Leary, M.D.

Wakefield.

S. W. Abbott, M.D.

Waltham.

H. D. Chadwick, M.D.
Marshall J. Mosher, M.D.
E. Irving Smith.
Charles A. Willis, M.D.

Watertown.

Vivian Daniel, M.D.
Julian A. Mead, M.D.

Waverley.

L. B. Clark, M.D.

Wellesley.

Edward Bancroft, M.D.

Westboro.

Francis E. Corey, M.D.
C. S. Henry.

Westfield.

James W. Holland, M.D.

Weston.

George Abercrombie.
F. W. Jackson, M.D.
S. Sanford Orr, M.D.

Whitman.

C. E. Lovell, M.D.

Winchendon.

F. W. Russell, M.D.

Winthrop.

A. B. Dorman, M.D.
Horace J. Soule, M.D.

Woburn.

Fred J. Brown.
George Buchanan.
James H. Conway, M.D.

Worcester.

F. H. Baker, M.D.
George W. Batchelder.
W. T. Clark, M.D.
James C. Coffey.
Prof. L. P. Kinnicutt.
J. F. McCartney.
L. F. Woodward, M.D.

Minneapolis, Minn.

F. F. Wesbrook, M.D., Honorary Member.

JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH

January Meeting, 1902

SUBJECT: Small-pox and Vaccination

JOURNAL OF THE

MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH.

ORGANIZED 1890.

[The Association as a body is not responsible for statements or opinions of any of its members.]

VOL. XII. April, 1902. No. 1.

JANUARY QUARTERLY (OR ANNUAL) MEETING

OF THE

Massachusetts Association of Boards of Health.

The annual meeting of the Massachusetts Association of Boards of Health was held at the Parker House, Boston, on Thursday, January 30, Dr. Samuel H. Durgin, Vice-President, in the chair.

The CHAIRMAN.— It may be hard, but we ought to come to order. We will first listen to the reading of the records of the last meeting by the Secretary.

Mr. James C. Coffey, Secretary, read the records of the meeting of October 23; and they were approved.

The CHAIRMAN.— The next thing on the programme is the election of officers for the ensuing year.

On motion of Dr. Swartz the appointment of a Nominating Committee was ordered; and the chairman named as the committee Mr. Pilsbury, of Boston, Dr. Emerson, of Springfield, and Dr. Everett, of Hyde Park.

The CHAIRMAN.—While the committee retires for this purpose, we will listen to the report of the Treasurer, Dr. Field.

Dr. FIELD.— Mr. Chairman, before the Treasurer presents his report, he feels that his thanks and the thanks of the Association ought to be given to Mr. Pilsbury, who has acted as Treasurer at the last two meetings. Not only has Mr. Pilsbury collected more money than I have been able to collect at similar meetings, but he actually has hypnotized three members of the Association into paying their dues a second time.

TREASURER'S REPORT FOR 1901.

Receipts.

Balance from 1900	$1,066.70
Interest	36.76
Annual assessments	304.00
Total	$1,407.46

Expenditures.

Printing and engraving	$93.00
Postage	38.05
Cigars and dinners for guests	31.70
Clerical assistance	28.00
Card ledger	8.13
Express, etc.	5.76
	$204.64
Balance to 1902	1,202.82
	$1,407.46

Of the balance of $1,202.82, $1,000 is in the savings bank, drawing interest.

Respectfully submitted,

JAMES B. FIELD, *Treasurer.*

Examined, and approved as correctly cast and properly vouched,

J. ARTHUR GAGE, *Auditor.*

On motion of Mr. Coffey the report of the Treasurer was accepted and placed on file.

The CHAIRMAN.— I have been requested by the Treasurer, a very modest and a very honest man, to say to the Association that he

feels that it would be a wise plan to place the Treasurer under bonds for $1,000. The Treasurer speaks in such a business manner about this as to carry conviction to his friends, and I am inclined to recommend it from a business standpoint. I presume a vote of the Association would make this legal. The Chair awaits a motion.

Dr. GAGE.— I move that the Treasurer be put under bonds of $1,000.

The motion was seconded by Mr. Coffey and adopted.

The CHAIRMAN.— I am very sorry to state that Dr. Shea, who is to read the paper of the afternoon, has been detained in court; but he has a hope that he can be here by half-past three. This time is not now far distant; and while waiting for the Nominating Committee to report, he may arrive.

The Executive Committee has a report to make upon the recommendation of new members of the Association. The Secretary will read the names.

Mr. COFFEY.— Mr. Chairman, the Executive Committee recommend the following persons for membership: —

BENJAMIN R. SYMONDS, M.D.	Salem
G. ARTHUR BODWELL	Salem
JOSEPH A. FITZGERALD	Salem
JOSEPH W. SAMPSON	Newport, R.I.
ALFRED E. GREEN	Duxbury
C. J. MCCORMICK, M.D.	Waltham
E. F. GLEASON, M.D.	Boston
FRANCIS L. LOWELL, M.D.	Somerville
JOHN A. MAGEE, M.D.	Lawrence
T. L. SWIFT, M.D.	Falmouth
W. E. HOLBROOK, M.D.	Lynn
W. A. WOODFALL, M.D.	Lynn
R. E. HILLARD	Lynn
E. E. STICKNEY, M.D.	Arlington
ROBERT W. HASTINGS, M.D.	Brookline
SUMNER COOLIDGE, M.D.	Watertown
S. O. MILLER, M.D. (of the Palmer Board of Health)	Three Rivers

Mr. Chairman, I move that they be elected to membership.

The CHAIRMAN.— You have heard the names read by the Secre-

tary, as recommended by the Executive Committee. What is the pleasure of the Association?

Dr. Swartz.— I move, under a suspension of the rules, if necessary, and by unanimous consent, that the Secretary be authorized to cast one vote for the names which are presented for membership in this Association.

The motion was seconded and adopted, and the Secretary cast the ballot in the affirmative.

Mr. Pilsbury.— The Nominating Committee is ready to report, if you are ready to receive its report.

The Chairman.— The Association will listen to the report of the Nominating Committee.

Mr. Pilsbury.— Mr. President, your committee appointed to nominate a list of officers for the ensuing year presents the following: —

For President, H. P. Walcott, M.D., Cambridge.
For Vice-President, (First), S. H. Durgin, M.D., Boston.
For Vice-President (Second), S. W. Abbott, M.D., Newton.
For Secretary, J. C. Coffey, Worcester.
For Treasurer, J. B. Field, M.D., Lowell.

For Executive Committee.

(for two years.)

G. L. Tobey, M.D., Clinton.
W. Y. Fox, M.D., Taunton.
W. H. Gove, Salem.
C. A. Hicks, M.D., Fall River.
G. H. Ellis, Newton.

Edwin L. Pilsbury.
H. C. Emerson.
W. S. Everett.

On motion of Mr. Pilsbury the Secretary was instructed to cast one ballot for the list as presented, and cast the ballot in the affirmative.

The Chairman.— The Secretary has cast the ballot as ordered by the Association. It goes without saying that all newly elected officers are grateful for their elections, and especially so in this case, as they are so new in the field.

It may be a trifle awkward to wait; we don't know how long before Dr. Shea comes. We are fortunate in having with us one who can entertain and interest you, and who may be induced to speak before his time. I am happy to call on Professor Sedgwick. [Applause].

REMARKS ON "OPPOSITION TO VACCINATION."

BY PROFESSOR W. T. SEDGWICK.

Mr. President, I thought, from the way you began, that you were going to call on somebody else, because what I have to say, I am afraid, may not be specially entertaining. My paper was to come at the other end of the programme; and it will be a good deal like the cart before the horse, I fear, because I am not an expert in small-pox. I never saw a case of small-pox. I don't know that I want to see one. You remember the lines about the purple cow: —

> "I never saw a purple cow,
> I never hope to see one;
> But this I tell you, anyhow,
> I'd rather see than be one."

It is a good deal so with small-pox in my case.

But what I was going to say, when my turn came, was what I think any intelligent citizen of the community might say regarding opposition to vaccination. There is a considerable number of people in the community who are honestly opposed to vaccination for small pox: there are others who, for their own purposes, pretend to be opposed to it. These last, it seems to me, don't deserve any con sideration; but I propose to deal as honestly and fairly as I can with the objections which some well-meaning people in the community really do feel, and honestly feel, to vaccination. It may seem that it is not worth while to handle this problem at all, because probably all of those in this room feel just as strongly and honestly as I do that vaccination is one of the most blessed things that was ever given to the human race. I certainly feel so. Personally, I have no sympathy whatever with the anti-vaccinationists; but I have seen some of them, I have heard and read of a good many of them.

I attended, for example, a hearing yesterday, when, in a large room at the State House, a considerable number of people, I should think one hundred, perhaps one hundred and fifty, applauded vigorously all attacks upon vaccination; applauded statements that, in the first place, the medical profession is interested in this thing pecuniarily, in the second place is interested in it as a kind of brotherhood, a kind of freemasonry which is concerned in keeping up the delusion of vaccination; applauded statements that vaccine is "poison," and referred to the common use of the word vaccine, "virus," as evidence of that fact; applauded statements that syphilis and consumption are wide-spread because of vaccination, and so on about other diseases; applauded a lot of statements which you and I believe to be absolutely wrong. It is not always well to pay attention, of course, to everything that is said or done in this world. There is a great deal of talk that is not worth heeding. But in America, especially, where we have popular government, and depend on the general intelligence of the people for all progress, I do believe that it is worth while to listen to the arguments of honest objectors and endeavor, if possible, to meet the arguments and convince their advocates. We may not hope, of course, to convince all of the objectors: many of them are so made that they apparently are not open to conviction; but some of them we may fairly hope will be, and at any rate the great public, upon which we have to depend for sound legislation and for the support of all good measures in our beloved country, will pay attention to arguments if they are put forward in a dispassionate, honest, and straightforward way. I think, for example, that in England they would never have had the trouble with the weakening of the law requiring compulsory vaccination which they have had if popular education and general intelligence were more widely diffused, — as widely diffused, let us say, as they are in Massachusetts. I have no fear that the anti-vaccinationists will upset our law regarding compulsory vaccination, — at least, I have no very deep fear of that, — because I believe that the intelligence of this community is adequate to deal with that problem. But, on the other hand, I don't believe that we can afford to pooh-pooh the whole thing, pay no attention to it, and simply laugh at it, because, if we do, we shall some day wake up to the fact that these people, by their incessant arguing and mis-

taken statements, have persuaded the legislature to follow their wishes. In fact, as you know, we have already got a weakening of our law in Massachusetts, which is unfortunate, to say the least, so that a child can attend school, provided a physician is ready to certify that the child is, in his judgment, not a fit subject for vaccination. That I regard as a disastrous first step toward the upsetting of a wholesome and beneficent law.

This is not a subject for vituperation. I am not going to imitate our opponents, who yesterday referred to the medical profession in all sorts of uncomplimentary terms, doctors even going up to the State House and claiming that vaccination is largely a matter of dollars and cents on the part of the medical profession, and, in general, using harsh language against what I regard as one of the noblest professions in the world,— language which I, at any rate, would not use. I must say, once for all, that I am not a medical man; and I have, therefore, as good a right to speak for the medical profession as any who spoke against it. I would like to say right here that this talk, while in certain cases there may have been grounds for it,— for there are black sheep, of course, in every flock,— could not, in my judgment, be more erroneous and misdirected. I have always maintained that there is no profession which, on the whole, does so much free and generous work for the poor, and for the people of the community, as the medical profession; and I am ready to state that fact publicly anywhere.

Coming right down to it, what are the arguments against vaccination? I regret very much to have to bring the subject up in this order, because, really, it ought to work the other way: you ought to be talking yourselves about dealing with cases of small-pox and all that; but at the same time, perhaps, once in a while it is not a bad idea to sit right down and hear from the other fellow, and, therefore, as fairly as I can, I want to state what seem to me the more rational objections of the anti-vaccinationists to vaccination.

First of all, they have a very strong point when they say that compulsory vaccination is a serious infringement of personal liberty. We have got to admit that. That is perfectly true. Compulsory vaccination is a very serious infringement of personal liberty. The whole idea of our government and our living is that, in general, a

man's house is his castle, and that his body and his religion and his politics are his own. When, then, he is seized "by four policemen," as they put it in their vigorous way, or, as we prefer to say, when he is taken by force, and vaccinated against his will, or when his child is vaccinated against his will, it is a serious infringement of personal liberty: there is no getting away from that. And yet one of the more rational of the speakers yesterday very truly said: "We infringe personal liberty, of course, in a good many ways. We take the criminal, and shut him up against his will. We stop people from trespassing upon the property of others. We frequently interfere with personal liberty." And he added, "But there is no case known in which we take a man and inject a disease into him against his will." He puts it in that way.

Now, if you have never heard about vaccination, never thought of it, particularly, as a disease, if you are a legislator, and this comes freshly before you, and people state it even far more excitedly and vigorously than I am stating it, you can see that it makes an impression. And they are right: it is a serious thing to take a man and make a hole in him, and thrust a disease germ into him against his will; for the cow-pox is a disease, of course, and, theoretically and in a large way, this is a serious infringement of personal liberty. When, however, they go so far as to say that otherwise we never interfere with personal liberty of the well and law-abiding, they go too far. If a man, well and otherwise law-abiding, were to be seen carrying a bundle known to contain small-pox clothing through the street, he would undoubtedly be stopped, and his personal liberty interfered with, and rightly enough: that would be an occasion for doing it. So also would a man, well and law-abiding, driving a load of gunpowder or dynamite through the streets. The whole thing comes down to this,—the greatest good of the greatest number. If we assume that vaccination is the beneficent thing that we believe it to be, then we believe that we have the right, for the good of the community as well as of the individual, to insist that a mild disease shall be taken by the patient in order to prevent him from having a fatal disease, or one very likely fatal, and in order to prevent him from distributing the fatal disease to others. So there it is, simply a question of less or more, the general good against the personal

preference, the sacrifice of individual liberty for the benefit of the public health.

Then the anti-vaccinationists say, "Well, that would be all very well, perhaps; but it depends on the assumption that vaccination is a preventive, which we absolutely deny." They boldly affirm that vaccination is not a preventive of small-pox. They admit that small-pox is a very serious disease; but, as one of them stated yesterday, they say that "all you need to keep off small-pox is a clean life, pure blood," and so on. He said he was a vegetarian. When one of the committee asked him if he had ever been vaccinated, he replied impatiently, "Years ago." [The person referred to was Dr. Immanuel Pfeiffer.] Now what is the basis of their claim that vaccination does not prevent small-pox? They simply go back to Jenner and the early days, when too much was claimed by him and others, when it was claimed that, if a man had been vaccinated once, he could never have small-pox. Some in their enthusiasm did claim that. I believe that Jenner claimed it. But to-day it is admitted by every one that a man may have small-pox after vaccination, that he may have small-pox a second time; but the chances are very much against either of these occurrences, and very much less than the chances of his having the disease if he has not been vaccinated. The anti-vaccinationists never state this side of the story: they always state their side only, which, put in their way, is of course impressive to those who are not familiar with the other side. We cheerfully admit to-day that revaccination after a few years is necessary for continued immunity.

Our opponents make statements, for instance, like this which was made at the State House yesterday. A woman physician said, "They used to inoculate for small-pox,"— I think that it was she who said it,— "they used to stick a dirty rag all full of small-pox material right into the arm of a person, and tie it in there, inoculate with it; and before vaccination came up that was the regulation thing. But this got so bad that by and by it was stopped by law." As much as to say: — Things being equally bad to-day, vaccination ought to be stopped by law. But what are the facts? The facts are that inoculation, which was introduced into England in 1717 by Lady Mary Wortley Montagu, and very soon much practised there and in this

country, was a wonderful preventive against small-pox. The history of inoculation is one of the most interesting chapters in the history of medical science. In looking it up, not long since, I was very much interested to find that in its way it was apparently very nearly as effective as vaccination, but, of course, more dangerous, because it was dealing with the regular small-pox. When vaccination came in, in 1796, and was brought over to this country also, it gradually became, of course, superfluous to do the more dangerous operation; and, although some old-fashioned people still wanted to do it, it was by law abolished, — in 1840, I think, in England. That is the truth in that statement. Inoculation was not abolished by law until a very much improved and simplified method, vaccination, had taken its place. It is telling a half-truth (and a half-falsehood), it is telling a part of the story, which makes the thing sound as it often does, in a hearing at the State House.

Then our opponents argue that vaccination produces a lot of other diseases, — a series of infections. They tell of people who have had bad arms, and of one man whose leg had to be amputated because of the vaccination illness that he had, and so on and so forth. We know, of course, that some people do have very bad arms. We will grant, for the sake of the argument, that some people may have to have their legs cut off, though I don't believe that any ever do. But how was it before we got vaccination and inoculation? Why, you have only to read the history of the times to know that scarce one person in a thousand escaped the small-pox; that one-fifth or one-sixth part of those attacked died; and that blindness and scarring and all sorts of miserable things were inflicted upon many of those who survived. Small-pox was then, and is now, a horrible, foul, loathsome disease. An occasional bad arm, or even an occasional lost leg, if you prefer, doesn't compare for a moment with the fear and pain and anguish and sorrow that came only too often in the old days. Our opponents suffer from a lack of perspective, from a failure to look at things in a large way, and see where the most beneficent results, after all, have come in.

Then they quote authorities, and in particular they quote Alfred Russel Wallace, who, as you know, was the codiscoverer with Darwin of the great theory of natural selection. Now Mr. Wallace is a

charming old gentleman, still living, I am happy to say, and one of the finest characters of the age. In the Malay Archipelago he discovered what Darwin had discovered in England; and you remember how he sent the account of his discovery to Darwin himself, and Darwin, taking counsel of Huxley and Lyell and others, published his own work with Wallace's. Wallace must always be mentioned with respect for his scientific work, especially that in connection with Darwinism. Wallace has lectured in this city, on the platform of the Lowell Institute, and in many respects is entitled to our warmest admiration and regard. And yet, when an anti-vaccinationist, as happened yesterday, refers to him as "one of the greatest of English statisticians," the reference is absolutely false. He is not a statistician at all, and never was a statistician. His article against vaccination is, nevertheless, the most effective anti-vaccination document that exists. Its title is "Vaccination a Delusion." The article is so persuasive that on one occasion a friend of mine, a distinguished scientific man, an officer of one of our leading educational institutions, and formerly an officer of the United States government, after reading it, said to me and to others, "I have always been a vaccinationist; but I must say that, after reading that article, I think the vaccinationists are put on the defensive." In other words, here is an eminent scientific man, who has written a seemingly effective article against vaccination. It is illustrated by statistical diagrams; for in this article Dr. Wallace does use statistics, though he is not a statistician, as his own diagrams sufficiently show.

In his article, Wallace reveals what is well known to biologists; namely, that he is a very different man to-day from what he was in 1858. That was a good while ago. He is getting old. His great paper was written in 1858. And we all know — that is, those of us who are biologists,— you medical gentlemen may not know — that Dr. Wallace is a spiritualist. In his book called "The Wonderful Century," in which his article "Vaccination a Delusion" appears, you will also find another article by him, entitled "The Neglect of Phrenology." He writes at considerable length, saying that we have made a great mistake in not looking at one another's heads more closely. That Dr. Durgin would probably grant to be true in regard to the school-children of Boston [laughter]; but, when it comes to

phrenology, it is a different thing. There is no one whom I admire in many ways more than I do Alfred Russel Wallace,— he is a fine old gentleman; but when he comes to write about vaccination, and vaccination a delusion, it is easy to show that many of his statements are lacking in accuracy or fairness, and that he has neglected wholly the experimental side of the question.

Experiment in these matters is the thing that tells; and what does experiment say? I will only mention one series of experiments,— one that was done right here in Boston, and its counterpart in the town of Milton near by,— a perfectly simple, but absolutely conclusive set of experiments. This was away back at the beginning of the century, in 1802 in Boston, in 1809 in Milton. The practice of the day was, as you know, inoculation against small-pox, in which people were actually inoculated with the germs of that disease. A number of children who, in the natural course of events, would have been inoculated with small-pox, were inoculated with cow-pox; and, when their arms had healed and everything was ready, they were afterward inoculated with the regular small-pox virus, as was the custom in that day. We should not do this to-day, because it would be regarded as vivisection,— "human vivisection," as those people who oppose vivisection would say,— as if every surgical operation of any consequence were not a human vivisection. But in those days everybody was in the habit of being inoculated with real small-pox who wanted to be; and, if he wanted to have his children inoculated, he did so, so that there was nothing remarkable in it at that time.

And what was the result? The result was that those children who had been vaccinated did not take the small-pox, and that children who had not been vaccinated and were inoculated at the same time with the same virus, did have the small-pox. Instead of going into elaborate statistics of the death-rate in 1766, and so on, which is a pretty difficult thing to get at at this distance, here are some simple but absolutely conclusive experiments made in Boston and repeated in Milton, from which I see no escape whatsoever. They chime in also with human experience, they chime in with the best evidence of the best minds of the age. And so I don't care what Wallace says or shows,— except that I am sorry to have him show so many things that, in my judgment, are not so,— because here are the experimental facts; and there are others, of course, confirmatory of them.

They quote Alfred Russel Wallace. They also quote Dr. Creighton, editor of the article on Vaccination in the ninth edition of the Encyclopædia Britannica; and they quote him with a good deal of satisfaction, too, because, as they say,— and I suppose it is true, — he began to write the article on Vaccination as a vaccinationist, but in writing up the subject he converted himself into an anti-vaccinationist. If this is a fact, it is an interesting fact and one which, of course, they seize and justly make a good deal of. All we can say in reply is that one swallow does not make a summer, and that, while here is one man who has written up the subject and converted himself into an anti-vaccinationist, our good Dr. Abbott of Boston, who has written on that subject for various encyclopædias, has come out more fierce than ever for vaccination; and so have all other writers, so far as I know, with this single exception. "The exception proves the rule," we may say, with justice.

I was interested to see whom our opponents would quote, and I found that there were only four whose names I had ever heard of; and those four were Wallace, of whom I have spoken, Dr. Creighton, of whom I have spoken, Herbert Spencer, whose opinion is merely that of a philosophical writer and entitled to no special weight, — no more than yours or mine upon this subject, perhaps not as much,— and lastly Professor Crookshank, a bacteriologist in London, a reputable bacteriologist. Those were the only names that I had ever heard of before. A Professor Newman was quoted, and a Professor Pickering; but who they are, I don't know. They certainly are not well known either in biology or bacteriology. And so, when it comes to the quotation of authorities, they are pretty limited, as you see, after all; and there is not very much need of stopping for them.

One of the stock arguments, which deserves some attention, I will now refer to; but, if Dr. Shea comes in, I hope somebody will let me know, because I want to stop the moment he appears. An argument which they make, and at first sight one of the most difficult to meet, is this: that sanitation is really responsible for the diminution of small-pox, and vaccination is only an aside in the matter. That is not, off-hand, an easy objection to meet, for it is a fact, of course, that the general death-rate has improved, and that sanitation has come

in and done a great work; and I personally believe, as others do, that sanitation has helped materially in the general decline of small-pox. The anti-vaccinationists go further, and claim that it is the *sole* cause of the decline of small-pox. Some of them even claim that we should have less small-pox than we do to-day if we did not vaccinate, because, they say, the germs of small-pox get into the vaccine virus, and we actually scatter small-pox by means of vaccine. That argument, of course, is not worthy of attention, because we never get small-pox after vaccination. But the main argument, that general sanitation has wiped out certain diseases and lowered the death-rate from others, is a strong argument, and one that appeals to people who are not familiar with the facts; and it will not do for medical men and board of health men simply to fall back on a general denial of this argument. You have got to give something more specific than that; and of course there is something more specific, a good deal more specific. Dr. Abbott can tell you how, when compulsory vaccination came into the German army, where there had previously been a good deal of small-pox, the small-pox *suddenly* fell to practically nothing at all,—*suddenly* fell, not gradually, but suddenly; and Dr. Wallace does not deal with facts of that sort. Again, look at Boston to-day. Is it any less clean and "sanitary" than for many years? No; and yet we have with us abundant small-pox.

There is another line of reasoning on this point, which to me is quite as conclusive and convincing; and it is this: when inoculation was introduced into England in 1717, the sanitary condition of England and of all civilized countries was very bad, and according to Dr. Wallace's own statements, in his book called "The Wonderful Century," the conditions remained bad as late, at any rate, as 1750 or 1775. The tide of modern sanitation did not begin to flow until about fifty years after inoculation had come in. Nobody can deny that. Dr. Wallace himself states it in so many words right in that same book in which he raises these objections. But how was it with inoculation for small-pox, which is, of course, only another kind of vaccination, a severer sort of vaccination? How was it when that came in? Why, the results were *immediately* beneficent and striking. Dr. Zabdiel Boylston, right here in Massachusetts, got

splendid results from inoculation. Benjamin Gale in Connecticut, and many people in England and other countries, got the most satisfactory results from inoculation, sanitary conditions remaining the same. There is a fact that cannot be got away from. The wave of improved sanitation had not begun until after the good effects of inoculation had come in. Unfortunately, if you choose to say unfortunately,— fortunately we ought rather to say,— it had begun before vaccination came in, and therefore it is not as easy to establish this point for vaccination as it is for inoculation ; but inoculation and vaccination have, so far as all observers at the beginning of this century testified,— and they were perfectly competent in these ways, —the same effects.

We can truly say that, when inoculation for small-pox came in in 1717, and for at least fifty years afterward, sanitary conditions were just as bad as ever. Everybody admits that. We had not begun to get better water supplies, we had not begun to get better heating or ventilation, or better streets, or better anything, until long after inoculation came in. And yet the immediate effect of that process was to reduce the number of deaths from small-pox enormously among those who had been inoculated, and the inoculation itself was attended with very little disaster. About one in eight hundred, according to Dr. Gale in Connecticut, died from inoculation, provided they had been taken at a time when they were well. The custom was, as probably you know, to go off for inoculation away from home, to a hospital, perhaps on the mountains. I have myself seen in Connecticut the site of an old inoculation hospital on a mountain near Hartford. To these out-of-the-way places people retired for inoculation. There they were actually " vaccinated " with the germs of small-pox (not cow-pox), at their own desire. Afterward they were insusceptible to the disease itself, and went about freely among small-pox patients, acting as nurses, etc., just as if they had had the small-pox.

I believe, gentlemen, that the State which requires this compulsory vaccination ought to provide the properly protected virus. I may be wrong in this, but I believe that that is the duty of the State, which requires the use of such virus ; and I think the time may well come when this Association should urge upon our own State a return

to the strict compulsory vaccination system, and couple with it the provision that the virus prepared under the care of the State shall be furnished free to all citizens.

I took down one or two of the wilder statements that were made yesterday. Here, for instance, is one that I took down verbatim: "Small-pox has increased in just the proportion that vaccination has increased." Of course, there is no use of dealing with a statement like that. Everybody knows that that is not so. Another person says, "Consumption has grown in proportion as vaccination has," which, of course, is also false. Another exclaimed, "A healthy, law-abiding citizen is never in need of restraint." But the healthy, law-abiding citizen who chose to carry sticks of dynamite with him through the subway would be restrained very soon; and, if he chooses to carry about the germs of small-pox, he should also be restrained. It is simply a question of the greatest good of the greatest number. Many of the statements made by anti-vaccinationists are so absolutely wild and obviously foolish that they are not worth dealing with at all; but there is in the community a considerable number of people moved by arguments like Wallace's, and, instead of simply turning them all off as of no account, I think we shall win more friends and strengthen our cause by taking up a patient, reasonable attitude, meeting argument with argument, meeting statement with counter-statement, branding, of course, what is really, obviously, and certainly false with that title, but not undertaking merely to waive the whole thing aside as of no account. I think that it was because our English brethren did that that their law got weakened, and that a strong anti-vaccination feeling has grown up in England. There is danger of something of the same sort in this country, error feeding upon ignorance. We ought to be able to give the reasons for the faith that is in us, not only to our own satisfaction, but to the satisfaction of any reasonable person; and those arguments ought to be able "to hold water," as we say, they ought to be substantial.

You, gentlemen, probably often have occasion to meet this sort of opposition, and can contribute much more to this discussion than I can. When I consented to say a few words, it was simply that I might stand up and be counted, and in order to express my feeling that we ought to take the attitude that some of our opponents are

honest, well-meaning people, who really have a grievance, or think they have, and who are to be met, not with scorn and silence, but by bringing forward the facts. We need very much, it seems to me, a simple, straightforward account of the whole matter, which shall be readable, and which can be put into the hands of those who are honestly seeking for information. Not long ago a distinguished scientific man in this city, a friend of mine, came to me, and said: "I wish you would give me some good documents on vaccination. I have been reading up on the subject; and, so far, I must say that everything I have read has led me to believe that there is nothing in it." Perhaps you can mention off-hand a good article, as good an article in favor of vaccination, I mean, — as readable by the non-professional man, — as this of Dr. Wallace's is against it. If you can, I should like to have it, because I meet such people as I have described, now and then. I don't know of any such article. I know of the valuable articles which Dr. Abbott has written for the "Reference Handbook of the Medical Sciences," but those are too deep for the ordinary reader: they involve some knowledge of statistics, hey involve some knowledge of health work and medicine; and your ordinary citizen, who goes up to represent his town or his city at the State House, does not get time to go through them, he is not familiar with the statistics and medical terms. We need very much something in favor of vaccination as readable as the paper of Wallace is against vaccination. [Applause.]

The Chairman.— Is there not some one who would like to speak upon the same subject before Dr. Shea arrives? This is practically a separate subject from that which will be treated by Dr. Shea. I think most of you must have some deep conviction concerning the work which is attempted by those who are trying to prejudice the public mind against vaccination. If this is not the body of men who have convictions upon this point, I should not know where to look for them. You have the administration of the health laws of this Commonwealth to execute. I hope most of you have not small-pox to deal with. While Professor Sedgwick has dealt fairly with this opposition which we have in the community, I think he has betrayed a more tender and considerate feeling than has been produced within me in the last few months. [Laughter.]

A MEMBER.— Mr. President, I think we should like to hear from you.

The CHAIRMAN.— There is little, perhaps, which I need to say about this question. I will not fail to say, however, that I have no sympathy with the men and women who are publishing rash and unfounded charges against vaccination.

Some weeks ago I made an offer to these people that, if I could get a few adult leaders of the anti-vaccination faith who had never been vaccinated, I would give them the privilege of seeing some cases of small-pox, studying the disease personally, and exhibiting the sincerity which they professed before the community. One man came and offered himself, but admitted that he had been vaccinated in youth. This one gentleman who came to offer himself for an exposure told me, when I informed him that he was not eligible under the proposition, that I would not be likely to find an unvaccinated person among the intelligent people. [Laughter and applause.]

There was one other, who came not to offer herself for an exposure, but who, laboring under a disappointment in losing a job of vaccinating, wanted to know if it was all provided for; and I said, "Yes, the job has gone into other hands." She looked and expressed herself as disappointed, and said that, if it really had got to be done, she didn't know why she should not do it, and wanted to know where she could get the best virus. That is the essence of hypocrisy, plain and simple; and this is one of the anti-vaccinationists in this town. Their stock in trade is the rashest assertions that it is possible to make.

One other man did come. He said he was a physician. I talked with him a moment across the counter. He said he had been vaccinated sixty years before, wanted very much to go to the small-pox hospital. I said to him that he might go and see cases of small-pox, having some reason to think it might be a good thing. I told him he might go to the hospital, and after a while he went. He did not appear to be interested in the cases or know much about the disease. He came away, and at once went into print, or tried to get a statement into print, an abstract of which was printed. He boasted of using his handkerchief about the small-pox patients, and coming up town and going into a congregation, where he waved his handker-

chief in the faces of his friends and others. I was asked what I thought of it, and it seemed to me that it must be either an insane man or a scoundrel who would do anything like that in any community. I have been unable to learn that there was any use of the handkerchief or any improper thing done whatever in the hospital by this visitor. He was attended by two medical officers throughout the hospital. He also indicated that he came near leaving the hospital without proper precautions. He was required to do in all respects like other men who had been permitted to go into the hospital.

I should like to add just a word,— that, inasmuch as something has been said about the production and purity of vaccine lymph, there will be a bill before the present legislature asking that the vaccine lymph for this State be produced and dispensed by the State Board of Health, from which we will have a good guarantee for pure and active vaccine lymph for our citizens [applause], just as we now have for diphtheria anti-toxine.

I understand that Dr. Shea is in the room. Doctor, will you take a position where you can be heard easily? and we will listen to you at once. Dr. Shea, of Boston.

SMALL-POX AND VACCINATION.

BY DR. THOMAS B. SHEA.

Mr. Chairman and Gentlemen of the Association,— I have to apologize at first for my delay. The only excuse I have to offer is that, as you all know, we must obey the summons of the court, when sent for.

I will, necessarily, the time being so late, make my remarks as brief as possible. I think it will be interesting for you gentlemen, connected, as you are in your official positions, with the different boards of health of the State, to tell you of the little flurry that we are now passing through in Boston as regards small-pox.

We have had about six hundred cases in the past three or four months. This has not been a very great surprise to us. It was foreseen and prepared for by the officials in our department. No longer ago than last July the situation was looked over very thoroughly,

and preparations were made to meet it. As you may remember, especially the older members of the Association, we have had no small-pox in Boston or this State for almost nine or ten years. We have had occasional cases, as you always will find in large cities,— imported cases; but, otherwise than that, the last was in 1892 or 1893, when we had about one hundred and fifty cases, and with this result,— that the city was well vaccinated at that time, and the disease necessarily disappeared. Since that time, conditions have been such that the seed has been planted; and, as I have said before, the past summer we recognized the fact that we were in for it, that we were to have small-pox here this winter, and a great deal of it, and why? The inhabitants of this city at the present time, or at least at that particular time I have reference to, in June, July, and August, were unvaccinated. Eight or nine years had passed; and at that time the people had lost the protective power of their vaccination; so, when they have been exposed to small-pox, they have contracted the disease.

Again, another factor must be considered. Yesterday morning I was at the State House, and listened to our friends, the "antis," making another assault upon our vaccination law. I must confess that they during the past five or six years have been up and doing. They have published their literature, they have distributed their circulars. We cannot go in any district of this city, we cannot find any cases of small-pox, without, inside of forty-eight hours, each and every one of the inhabitants having placed in their hands a circular from the Anti-vaccination Society condemning vaccination.

As regards the disease itself, I do not believe that I can say much that would be of benefit to this Association. Much has been said, and much has been written. As regards vaccination, I think there is much to be said. We have been preaching the subject of vaccination day in and day out, and I hope with some success. For vaccination, like all great discoveries, in the beginning too much was claimed. Even Jenner himself in the beginning claimed that one successful vaccination conferred immunity on that particular individual for life. As you all know, that statement has not been borne out by experience. Vaccination in itself, if properly performed and at the proper times, is a sure preventive against small-pox.

I do not think that it is necessary before this Association, or before these gentlemen comprising the Association, to prove, or to take up much of our time in endeavoring to prove, that vaccination is protective against this disease. We have seen the power of vaccination. Our physicians, our ambulance drivers, our disinfectors, our nurses in the hospital, our attendants, have lived and slept with small-pox for the last four months. And with what result? Not a case. Not one case that I have known of in which any of our attendants, physicians, or anybody connected with the Health Department that deals with this particular disease, has contracted small-pox. I think that in itself is a sufficient argument about the protective power of vaccination. But, on the other hand, vaccination must be performed at the proper intervals. I have seen probably every case of small-pox that has been reported in Boston within the last ten years; and I have not seen personally any individual contract small-pox, or even varioloid, that was successfully vaccinated within ten years. As regards myself personally, I have not had a successful vaccination for seventeen years. But I think and I know that, if any man will walk through a small-pox hospital and see the patients there and see the conditions and see the suffering, if he has neglected his vaccination, it will be a stimulus for him to be immediately vaccinated. I make frequent vaccination a rule, and it is a rule of the Health Department with men employed in handling small-pox. In an epidemic of this kind, to be on the safe side, we order our ambulance drivers, our disinfectors, our nurses, at least once a month and sometimes once in six weeks, to be vaccinated and revaccinated. That is the whole secret of the protection from small-pox. It is revaccination. There is no reason why anybody living in this world to-day, if there is any possible way for him to be vaccinated, should have small-pox.

Now as regards the diagnosis of this disease, small-pox. Probably it would be of interest, especially to the health officers, if I might say a few words on the diagnosis of this disease. I think that, if you have not met it already, probably you will have to face the situation; and I might be able in a few minutes to tell you something that might be of assistance. As you know, small-pox is one of the acute infectious diseases, with a period of incubation of ten or twelve days,

some others say thirteen or fourteen. In cases we have had under observation after exposure, we know that the time of exposure never has gone over twelve days. The onset is sudden, high fever, headache; and, to my mind, a very strong diagnostic symptom is the backache. I should say, in the case of six, probably, or seven, out of ten patients that I have seen in the beginning of the disease, the examination would show a plaster on the small of the back, showing that this symptom is fairly constant. At the end of the third day we have the eruption. Before the eruption appears in small-pox, I do not see how it is possible to make a diagnosis or to say that a person is afflicted with small-pox. Of course, the disease then passes through the several gradations, through the papular eruption, lasting twenty-four or forty-eight hours, then becoming vesicular, then pustular, and after the secondary fever the stage of incrustation and desquamation. The treatment for this disease is, to my mind, merely good nursing, — typhoid fever not excepted. Give me a patient with small-pox, all I require is a good nurse, a good faithful nurse. Nursing is everything, and next to nursing the alimentation. You can understand the terrible drain upon the system from this disease, and it requires much alcohol and much proper food.

Now as regards making a differential diagnosis in this disease and the diseases with which it is most frequently confounded. It is mistaken for, probably, measles, syphilis, drug eruptions, and that great bugbear, I think, to every physician and every health official, — chicken-pox. Chicken-pox, you know, is passed over very lightly in the text-books. The modern text-books, I think, devote half a page to chicken-pox, saying it is merely a children's disease, and that, if it occurs in adults, you are dealing with small-pox. This statement is not borne out by experience. We see very often cases of chicken-pox in adults. Measles sometimes, probably, is mistaken for small-pox, especially in people with dark skin or in colored people. But the temperature alone, in a case of small-pox, probably at the acute onset the temperature being 103 or 104, with severe constitutional symptoms, the appearance of the eruption making a decided change, the patient feeling so much better: whereas in measles you have the suffusion of the eyes, the coryza, the appearance of the mouth, and, instead of the temperature having a sudden drop, it

continues at the same height, and even higher. Then as regards the drug eruptions. Eruptions from bromide of potash, iodide of potash, and copaiba, during the past few months have been reported to our department as small-pox. I think the history, in the absence of any fever, would enable you to rule out small-pox.

Now we come to chicken-pox. Chicken-pox, I should say, or varicella, is a disease sometimes closely assimilating small-pox, especially if we consider small-pox that has been modified by vaccination; but the history of the two diseases is entirely different. I only speak from my own experience. No matter how mild an eruption or how sparse an eruption a man is going to have who is attacked with small-pox modified by vaccination, the initial fever will be very severe. He will have his high temperature, his headache, his back-ache very constant, and the appearance of the eruption might be very sparse, as I said. But in varicella the usual history is, probably, for a day a little headache and the next day the appearance of this eruption. In the cases seen in private practice, when seen by the physician, the eruption is always vesicular. Then another very strong diagnostic sign,— the eruption is very copious on the back and chest. This is entirely different from variola. In variola you find the eruption very copious in the face and especially on the hands, where the extremities have been exposed to the air. As I say, in chicken-pox this eruption is vesicular. The vesicles break down easily; and, when they rupture, either spontaneously or from trauma, they commence to dry up in the centre, and you find something that has been pointed out as an umbilication. Of course, that is no true umbilication: it is merely the drying up of the pock in the centre. You do find lesions in the throat; and sometimes lesions are found in the hands and feet,— on the palms of the hands and the plantar surfaces of the feet. But these lesions are entirely different in varicella than in true small-pox: they are superficial, whereas in small-pox they are firmly and deeply implanted in the skin.

To sum up now in just a few words, gentlemen, I think our duty, very strong, is to talk vaccination. It is a simple proposition. If we could say to-morrow that every person in this State would be vaccinated, small-pox would disappear inside of three to four weeks. It

is a very simple proposition. We have it in our own hands, if we only could vaccinate our people.

Of these people that do not believe in vaccination, some have paid dearly for their opinions. I want to cite just one case, or a few cases, to see how dearly they have paid for their convictions. I was called to see a patient about six weeks ago who was suffering with small-pox; and, after the arrangements had been made for the transfer to the hospital, I asked the nurse, as a matter of routine, "When were you last vaccinated successfully?" She said, "I was never vaccinated," very strongly and very boldly. I said, "What, never?" She said: "Never vaccinated. I don't believe in it." I tried all my art of persuasion. I pictured to her the grave peril she was in, the grave danger, and told her that I probably would come and get her in ten or twelve days, and take her to the hospital. She had the courage of her convictions, gentlemen; and I did come in twelve days, and she went to the hospital. She was a young woman, just through her professional school, having graduated as a nurse. I took her to the hospital. She is still living. She is in bed. But I am sure that when she leaves the hospital and sees her condition, and sees how she is disfigured, utterly useless for her calling, she would much prefer to have died rather than to have recovered.

Another case. A young man was found in the city suffering with small-pox, and was carried to the hospital. No hope could be given to his people: he was an unvaccinated subject. Gentlemen, what legacy do you think he left his father? In searching through his effects, a circular issued by our friends, the anti-vaccinationists, was found in his pocket; and his father said that that accounted for his obstinacy in refusing to be vaccinated. His father and the rest of his family had been vaccinated within three months successfully, and this young man refused vaccination; and he paid dearly for his convictions. He went to the hospital, and he died within seventy-two hours.

Gentlemen, I could go on as the result of this flurry of small-pox in Boston, and cite you cases sadder than the two I have mentioned. Our friends, the anti-vaccinationists, said in the State House yesterday, "All we come here to speak for is the dear little children, our dear little children"; and, gentlemen, I think that is the strongest

argument that can be made before that committee to-morrow,— to go there and speak for the dear little children. I will not detain you a minute, but I must tell you about one of the saddest cases that has come to my experience during this past sickness here in Boston. One of our physicians was called to a man who was found suffering with small-pox. He found a family unvaccinated,— two children under school age unvaccinated, two children of school age, who, thanks to their being sent to an honest physician for a certificate to go to school, had been vaccinated, the father unvaccinated, and the mother unvaccinated. They were anti-vaccinationists. They did not believe in it, and would not have their children vaccinated unless they were obliged to in order to go to school. The physician tried to prevail on the woman to be vaccinated. That there was still time to ward off this disease was of no avail. The conditions were so sad that I myself made a personal visit to this house, and talked to this woman. I pictured the grave danger she was in, not only herself, but her two children unvaccinated; that, as surely as day followed night, if they remained unvaccinated, they would contract this disease and die. It was of no avail. The father was taken to the hospital. The mother refused to be vaccinated, and she went to the hospital. With what result? The father died. Then the mother died. When the mother was removed to the hospital, we took those two unvaccinated children; and they came under our care, and we vaccinated those children for five days, day after day, and one was saved, did not contract small-pox, and the second one was sick probably for three days and developed, I should think, about fifty papules, and the disease aborted. The mother and father are dead; and those four children are orphans, I suppose wards of the State.

Gentlemen, those are some of the results that we have found in Boston to-day as the result of the anti-vaccination. And that is the reason, and the only reason, that small-pox is in Boston to-day and the other cities of this Commonwealth. It is because the people refuse vaccination. [Applause.]

Mr. Pilsbury.— Mr. Chairman, I do not wish to intrude at this time, because I can offer nothing in the way of argument. But, before this large representative body adjourns or many go away, it

seems to me that it would be proper to introduce the resolution which I hold in my hand.

The Chairman.— I hope as many as possible can spare the time and will remain, because there are many good things yet to be said. I wanted to say, before any more left, that to-morrow at ten o'clock at the State House there is to be a hearing on the part of those who remonstrate against the proposition to do away with the compulsory vaccination laws of this State. And I think that you will do no better service to your State than to present yourselves there in goodly numbers and protest by your presence, if not by words, against this extraordinary proceeding. One amendment of the law was secured by this same class about five years ago, and it is so worded as to permit these men and women who oppose vaccination to secure the attendance of perfectly healthy children in our schools by merely asserting their personal opinions against vaccination. The law says that, if the child brings a certificate from a practising physician stating that the child is an unfit subject for vaccination, it can be admitted into the schools. What is the result? No physical disability whatever is necessary in order to secure this certificate from the anti-vaccinationist. You cannot prosecute this party for a false certificate: they have complied with the letter of that law. It is simply a convenience for this anti-vaccinationist to assert his opinion that nobody is a proper subject for vaccination. Now, shall we sit by and permit our statute laws, which mean protection to our citizens, to be emasculated in that way? It is just what will be done if you and I don't show a spirit of resistance. Will you go, or will you submit to these inroads upon wholesome laws?

Mr. Pilsbury.— Mr. Chairman, because 400,000 people or more in the city of Boston have voluntarily submitted themselves to vaccination and revaccination, we might lull ourselves into a feeling of repose, and into the belief that the legislature would not for a moment entertain the proposition which is before the legislature of which you have spoken; but, after listening to the calm and dispassionate and gentle manner in which Professor Sedgwick has told us of the anti-vaccinationists, I think we may be more than ever convinced of the danger, and therefore I offer this resolution:

The Massachusetts Association of Boards of Health, in annual session assembled, representing in its membership all sections of the Commonwealth, declares its firm belief in the efficacy of vaccination as a prophylactic for small-pox, and desires to enter its emphatic protest against the repeal of the compulsory vaccination law as contemplated by a petition and bill now before the Massachusetts legislature.

I move the adoption of this resolution, Mr. Chairman, and that a copy be sent to the Committee on Public Health, which is holding these hearings.

Cries of "Second the motion."

Dr. Ahearne.—Mr. Chairman, as an amendment to that motion I would move that a delegation from this association be requested to present itself at the meeting to-morrow.

Professor Sedgwick.— Mr. Chairman, I should like to second that motion. I think it is of great importance that this Association should be well represented to-morrow morning at 10.30. The other side has finished, and from 10.30 to 1 there will be an opportunity for those who believe in vaccination to make themselves heard and felt. I warmly second the amendment and the original motion.

The Chairman. — The amendment of Dr. Ahearne is now before the Association. [Cries of "Question"]. It is an amendment to Mr. Pilsbury's resolution to this effect,— that a committee of this Association be requested to attend the hearing to-morrow at the State House, to protest against the repeal of the compulsory vaccination laws.

Dr. Ahearne.— To be appointed by the Chair.

The Chairman.— To protest against House Bill No. 128. It is moved and seconded that a committee be appointed by the Chair to attend the hearing to-morrow at the State House to protest against this bill.

The amendment of Dr. Ahearne was adopted.

The Chairman.— Gentlemen, I am tempted to appoint the entire Association. [Applause.] Without a particle of fun in it and with the most serious feelings, it seems to me that no member who is able

to go should feel hindered by the appointment of a few others; and it strikes me that each will feel an equal responsibility if all are invited to go there, or as many as can conveniently do so. You know that this thing occurs now annually. It is only a week ago yesterday that a hearing was attempted; and the petitioners asked the committee to postpone the hearing, to accommodate a new organization which was being formed to help them on this work. With this in mind, it does not seem too much for all who are engaged in this public health work to lend a hand in opposition. Words have been fitly spoken by Professor Sedgwick to us this afternoon concerning the situation. We must not blame legislative committees who have this matter in charge. They must hear the petitioners. They are not all physicians, they are not public health officers: they are representative men, sent there and charged with the duty of listening to petitioners. If we would treat them as we would like others to treat us under similar circumstances, we will go there and help them to understand both sides of the case. Therefore, I beg to put you all on the committee; and you are appointed to go there to-morrow and do your duty. [Applause.]

Dr. Magee.— Mr. President, while a young member of your Association, I have been practising for the last thirty years in this Commonwealth. Yesterday I was called to see a case; and I would like to cite that case to you, so as to see what the duties of the Board of Health of our city and vicinity should be. I was called yesterday morning to see a case of small-pox in an unvaccinated patient. To my mind, it is a very malignant case of small-pox. After having the case isolated and taken care of, the agent of the Board of Health and myself went to one of our mills in the city of Lawrence; and there we found a young man in the papular stage of small-pox. Our Board of Health had been notified of the case. This man, who has had small-pox, slept last Friday night and Saturday night and spent Sunday in a house in our city, having had the eruption, the pustular stage, at that time. Now, is it the duty of our Board of Health to stop those people from mingling with the community without going to any form of law to do that? And is it not the duty of the Board of Health of our city to order a general vaccination? It is for a question of information that I have cited this case. Will our Presi-

dent or some gentleman present who knows what should be done inform us? Our members are here, and I would like to have them instructed, as far as they know.

Dr. Hill.— Mr. Chairman, before taking up the answer to Dr. Magee's question, I would call attention to the fact that the resolution brought up by Mr. Pilsbury was not passed; and it seems to me important that it should be, as well as the amendment. It has been suggested also that to appoint a committee without a chairman to act as spokesman would perhaps leave the committee at rather loose ends. And, even though the whole Association should go up there, there should also be a spokesman.

The Chairman.— Are there any remarks to be made upon the resolution offered by Mr. Pilsbury? If not, those in favor of this resolution will say ay; contrary minded no. It is a unanimous vote. I have to confess to Dr. Magee that I lost the question which he asked. If he will make it pointed, I will try to answer it.

Dr. Magee.— I will simply state that we have got a case of small-pox that is outside of our city, right on the line; and that case probably was contracted in our city. This patient, who has broken out with malignant small-pox, an unvaccinated case, slept at a house Friday and Saturday and spent all day Sunday in our city. He was in a pustular condition last Sunday. There are in that house probably twelve to fifteen people. The agent of the Board of Health and myself went to one of our mills, which employs about two hundred hands or three hundred hands in the one building, and found a young man there in the vesicular stage of small-pox. I wanted for my own information, and I know it would be kindly received by the chairman of the Board of Health and the other member who is present, to know definitely what action can be taken to vaccinate or to close those people up without going through a process of law. As I understand it now, to isolate a home, you have got to have a warrant and go before two justices of the peace before the Board can order that done. Is that a fact?

The Chairman.— We don't do it that way in Boston. There is not time. I should take every person who had been exposed to a case of small-pox, and either see him vaccinated thoroughly, and watched carefully for two weeks, or quarantine him for two weeks.

Dr. Magee.— Would you allow those persons to mingle with the general public, work in our paper-mills, and work in our factories, that have been in contact with that patient?

The Chairman.— After vaccination and cleaning up, yes, and watch them. If I had any doubt about keeping an eye on them, I would shut them up. No man can convey small-pox during the stage of incubation, if he is clean outside. You will be able to detect the early symptoms of small-pox before the patient would be able to convey the disease to others.

Dr. Magee.—My friend, Dr. Shea, who read a paper a few moments ago, said that one very important symptom was backache. I found one young man with a temperature of 99½ and with a very, very severe backache; and I have been very suspicious of that young man, that he is going to come down with small-pox. Last evening he went to work in one of our paper-mills, where there are probably four or five hundred hands.

The Chairman.— When he gets the backache, your suspicions may be greatly increased; but you cannot say he will have small-pox until it appears.

Mr. Pilsbury.— What is everybody's business is nobody's business; and, while I agree with the chairman that it would be a grand thing if this entire body would present itself at the State House, I do not believe they will go. I believe there will be but few. I think it would be far better, while I dislike to differ with the chairman, if he would appoint a special committee — make it as large as he pleases — who will accept the duty imposed upon them.

A Member.—I second the motion, Mr. Chairman.

The Chairman.— There is a motion before the house which must be entertained, and it is all right. Is there anything to be said upon this motion, that the appointment of the committee be revised, and that a specified number be appointed, who shall consider it their duty to go before the legislative committee?

The motion was adopted.

The Chairman.— I will ask those who feel that they could go, and would go, to stand up. Now I want your names, and will ask you to give them to the Secretary.

Mr. Pilsbury.— Mr. Chairman, what time is the hearing? The question is asked.

The Chairman.— 10.30 a.m., at the State House, before the Committee on Public Health. I would suggest that the volunteers write their names on a slip of paper for me, and that list will constitute the committee which I will appoint to go to the State House tomorrow on this commendable work.

Mr. Pilsbury.— Write their names and location, also.

The Chairman.— Yes, write your name and location, and hand it in to the Secretary.

The list of the committee, as compiled in this way, was as follows: —

E. E. Bancroft, Wellesley.
Dr. E. M. Hartwell, Boston.
Dr. C. L. French, Clinton.
Dr. A. M. Miller, Needham.
Dr. W. G. Brown, Plymouth.
Charles A. Willis, M.D., Waltham.
S. A. Spear, Brockton.
Charles Cary, Brockton.
Dr. F. J. Ripley, Brockton.
William H. Mitchell, Boston.
S. C. Keith, Jr., Boston.
Albert B. Dorman, M.D., Winthrop.
Dr. N. K. Noyes, Duxbury.
Dr. G. Osgood, Rockland.
Dr. J. C. Batchelder, Rockland.
Dr. J. F. Worcester, Dorchester.
D. S. Everett, Hyde Park.
William W. Scott, Hyde Park.
W. C. Kite, Milton.
Henry D. Chadwick, M.D., Watertown.
M. J. Mosher, M.D., Waltham.
R. S. Nye, Falmouth.
T. L. Swift, Falmouth.
George L. Tobey, M.D., Clinton.
Arthur R. Perry, M.D., Somerville.
Charles Harris, Cambridge.
Dr. C. A. Ahearne, Salem.
R. L. Newcomb, Salem.

Dr. Perry.— Mr. Chairman, there is a source of infection to which hitherto not much attention has been paid; namely, the distribution of mail matter infected by letter-carriers or other employees of the Post-office Department who have been brought into physical contact with cases of contagious disease.

The danger of infection from such a source was recently brought to the attention of the Somerville Board of Health by a specific instance, and it seemed to them perfectly evident that some precautionary measures ought to be taken. They were immediately confronted, however, by the difficulty that such infection might be due to a carrier or mail clerk who was entirely outside of their jurisdiction, and over whom neither municipal nor State authorities could have

any possible control, because they can exercise no powers respecting incoming mail without serious interference with the mail service.

For example, mail collected in other States adjoining Massachusetts is usually distributed in this State within a few hours; and the consequent danger, if such mail matter is handled in the adjacent State by a person who has been brought in contact with contagious diseases, is certainly evident. Moreover, infection in the same way is certainly possible at however great a distance from us the mail matter might originally have become infected.

As this condition of affairs can be prevented only through the Post-office Department, I offer the following resolution: —

Resolved, That proper consideration for the health of the people of this Commonwealth requires that no employee in the United States Post-office Department should engage in any business which from its nature tends to bring him into physical contact with persons suffering from any contagious disease, such as the practice of medicine or healing in any form, nursing or care of the sick in any form, employment in a hospital, undertaking business, etc.; and that the chairman appoint a committee of three to forward a copy of this resolution to the Post-office Department at Washington, and request the department to take such action as it may deem most expedient to prevent its employees from engaging in any such occupation or business as is referred to in said resolution, and that this committee make a report of their action and the result thereof at the next meeting of this Association.

Dr. Fisk.— Mr. Chairman, I should like to second that.

The resolution was adopted. The chairman subsequently appointed Dr. A. R. Perry, of Somerville, Dr. S. W. Abbott, of Newton, and Mr. J. C. Coffey, of Worcester, as the committee provided for by the resolution.

Dr. Magee.— If I am not out of order, if it is proper to make the motion now, I would like to move that Dr. Durgin be chairman of the committee which is to appear before our Representatives to-morrow at the State House.

Dr. Abbott put the motion, and it was adopted unanimously.

The Chairman.— I beg pardon for not hearing and understanding the motion as it was put. I doubt if it is possible for me to be there. I think also, considering the situation as it stands to-day, and has

been standing, that it would be a matter, even if I could be there, of considerable delicacy, inasmuch as we have a most competent, energetic, and successful leader in this now in the person of Professor Sedgwick. [Applause.] He not only has been, but is to-day, the manager of this thing. I am sorry I did not hear the name until after our worthy Vice-President had put that motion, otherwise I should have informed you, so that you would not have pressed the motion.

Dr. Magee.— The reason why I made that motion was that you have been connected with the board in the city of Boston, chairman of that board. Professor Sedgwick has been a layman. I thought that it was the duty of the President of this organization to be there and to represent the organization, and of Professor Sedgwick to represent it as a layman. That is why I made that motion.

The Chairman.— I wanted to say, and I am glad you have brought this out in this way, that it is my judgment, and that of all those who have discussed it carefully, that it is much better for the physician to be second in this matter. Our strength lies to-day in furnishing such data as we can to the business men and laity of this Commonwealth. It is time that they should come forward, and say, "We, too, have an interest in this great public question." The greatest strength can be shown in the person of the business man, the president of a college, representatives of our great educational, mercantile, and commercial interests, the non-medical man, else I am more mistaken than ever before in my life. I beg you to see that the best thing we can do is to let the business man and the laity go forward, and we support them the best we can.

Professor Sedgwick.—Mr. President, I think that Dr. Magee is right; and the motion has already been passed. I prefer to go up as one of the laity. I have kept my name off: I have not even handed it in to the secretary. I shall be on deck to-morrow, and I shall be heard; but I think this Association of Boards of Health ought to be represented by one of its officers. They need not take the entire morning, of course. I think, if we could get a clergyman, it would be a good thing, and a professor, and people other than doctors; but this Association should be represented by one of its officers, and, if possible, by its vice-president. I think Dr. Magee is quite right; and I think Dr. Durgin is right, so far as to say that the

laity should be represented. I want to go as a simple citizen of Massachusetts, one who is not a doctor; but I want the doctors there in force. They ought to be, because the committee will want to see them. I have told Dr. Shea that, if he did not come up to-morrow morning, I should ask the committee to send for him.

Dr. MAGEE.— Then I think I had better not withdraw my motion.

Professor SEDGWICK.— No, indeed.

The CHAIRMAN.— Our programme, gentlemen, is not quite completed.

Dr. NOYES.— I want to ask a question that was brought up by something you said a moment ago. In the matter of the certificate of disability, I judged you implied, from what you said, that any anti-vaccinationist who happened to have a license under the Medical Practice Act could furnish such certificate; and it was implied that he could furnish it without seeing the patient. Is any school board justified in accepting a certificate from a doctor who has not seen the patient? I ask that, because there is trouble in our section with people who are sending up to Boston, and for a dollar apiece are getting the certificates of disability.

The CHAIRMAN.— I am told that it is not necessary to see the patient at all in order to secure this remarkable certificate. I know that, when such certificate is presented, the school-teacher has no discretion whatever.

Dr. NOYES.— Suppose the school board refuses to accept those certificates?

The CHAIRMAN.— If they refuse to receive the pupil with that certificate in hand, the natural process would be for the parent or some interested party to ask the court to order the honoring of this certificate; and it would have to be done.

Dr. NOYES.— And, in your opinion, the court would have to order it?

The CHAIRMAN.— Yes.

Mr. SCOTT.— Mr. Chairman, the gentleman who last spoke spoke about the certificates being issued. I wish to give you our experience in Hyde Park. We have had nine cases of small-pox there. All the children in the schools have been examined. Some of the children

have certificates from physicians in Boston, which they procured without being seen by the physician in attendance; and we have taken the position there that, if a child is an unfit subject for vaccination at this time,— a time of epidemic, or a time of small-pox in Hyde Park,— that child is an unfit subject to go to school. We have gone on those lines. We have not been sued yet, but we expect to be. In Hyde Park there are no children going to school that have not got a certificate of vaccination by a physician.

A MEMBER.— Am I in order if I ask Dr. Shea three questions?

The CHAIRMAN.— In justice to those who have promised to speak on the question, we ought to hear them first; and then you shall be heard. I will call on Dr. Abbott for a few remarks on the paper.

Dr. ABBOTT.— Mr. Chairman, after hearing such an effective statement as Dr. Shea has made, it doesn't seem to me that I can add anything as an argument for vaccination, after the personal experience that he has shown here before this body. It seems to me it is one of the most effective statements I ever heard in my life.

The greatest general statement upon that subject — in fact, the most magnificent argument for vaccination — is the position of the German Empire to-day. I have here their official reports of the Imperial Board of Health, if any one wishes to consult them. Every child in that country is vaccinated between the age of eight and twenty months, and every child is again vaccinated before twelve years of age. There is no such thing in that country as what we have here, — spasmodic vaccination once in a few years, here and there and in different places, and here and there at different times. It is nearly three millions of people vaccinated every year, and those are almost all children.*

And what is the consequence? We have had the argument stated here in regard to time; that is, that small-pox is not so common now as it was in the last century. That is true, and it is also true that some other diseases are not so common; but, when you come to compare countries one with another, here is one great empire of forty-five million people where small-pox is practically unknown, excepting in the few instances of immigrants who come in there having just been exposed in Russia, in Austria, in Italy, in Switzerland,

* The numbers vaccinated in 1897 and 1898 were 2,863,111 and 2,914,427.

and in France. Those are the only cases that have it, excepting the very few children who may be attacked and have not yet arrived at the vaccinal age.

I would just say a word in regard to the character of the opposition which has appeared in these vaccination hearings. A gentleman came last year from Brooklyn, N.Y.— if you were there at that hearing, you will remember it,— and showed upon the wall a diagram and a great many figures in regard to the city of Leicester, England, the hot-bed of anti-vaccination. I could not answer them at that time, because I don't carry the figures of all the countries in the world in my mind, and I did not know what the facts were; but a few days ago I came across them. What are the facts in regard to Leicester? In that epidemic, which occurred about 1892 or 1893, during the session of the Parliamentary Committee upon vaccination, there were 357 cases of small-pox that occurred in the city. Of this number, 198 occurred among people who had been vaccinated at some time in their infancy or childhood; and there was 1 death among that number. Among the remainder there were 19 deaths. I cannot see where he could get any comfort for the anti-vaccination argument out of that record. But the most cruel circumstance in this epidemic consists in the fact that, while scarcely any deaths occurred among the adult population of Leicester, most of whom had been vaccinated in early life, there were 131 cases and 16 deaths among children whose parents had neglected to have them vaccinated.

Another argument that was brought forth was the statement that the British Parliament has repealed the anti-vaccination laws. I will read to you the amendment, and I will ask you just to consider the terms of that amendment to the British vaccination law: —

No parent or other person shall be liable to any penalty under the Vaccination Act of 1867, if within four months of the birth of the child he *satisfies* two justices or a police magistrate that he (the parent) *conscientiously believes* that vaccination would be prejudicial to the health of the child, and within seven days thereafter delivers to the vaccination officer a certificate by such justices or magistrate of such conscientious objection.

When you come to such an indefinite provision as that, what does it amount to? He must satisfy two justices, make them be satisfied,

that he himself is a conscientious objector to the vaccination of his child. A single case was tried in court not long after that, the only case that has come up to my knowledge under that act. It will not take long for me to read it. The first appeal under the Vaccination Act occurred in 1899, in the case of *Regina* v. *Welby*, *ex parte* Bird, Jan. 27, 1899. These are comments made by Dr. Hime, in his book entitled "The Public Health Acts of Great Britain": —

The absurdity of the provisions of Sec. 2 (1) of the Vaccination Act, 1898, which require that the parents or person responsible for having a child vaccinated must "satisfy" the magistrate before whom he is brought that he "conscientiously believes that vaccination would be prejudicial to the health of the child," in order to escape liability to a penalty under Sec. 29 or Sec. 30 of the Vaccination Act, 1867, was fully demonstrated in the above case, which formed the ground of the first appeal under the section.

One Walter Bird had endeavoured to "satisfy" the stipendiary magistrate of Sheffield as to his child, as required by Sec. 2 (1) of the Act, but failed to do so. Being convinced that the stipendiary ought to have been "satisfied," he applied for and obtained a rule from the Court of Queen's Bench (the Lord Chief Justice and Mr. Justice Wills), calling on the stipendiary to show cause why a *mandamus* should not issue directing him to hear and determine the case, as he had declined to grant exemption to the child on the ground that he did not believe that Bird conscientiously believed that vaccination would be injurious to the child.

In granting the rule, the Lord Chief Justice said, *inter alia*: —

"The section clearly said that the magistrate was to be satisfied, not in his opinion that vaccination would be prejudicial to the health of the child, but satisfied that the applicant conscientiously believed that vaccination would be prejudicial to the child."

Who ever heard of such an indefinite law? It is the greatest case of the mountain laboring to bring forth a mouse ever known. This Parliamentary Committee sat for seven years, and the testimony is published in volumes amounting to over 3,000 pages. Professor Alfred Russel Wallace, referred to by Professor Sedgwick, was one of the witnesses who was examined at the time.

When the case came on for hearing before the Divisional Court (Lawrence and Channell, JJ.), after the affidavits of the parents had been read and explained by counsel, who stated that the parents had been prosecuted, and had suffered great inconvenience,

Channell, J., said: "The magistrate said in his affidavit, 'A certificate was not given because I was not satisfied that he believed that vaccination would be prejudicial to the health of the child.' They could not grant a *mandamus* to compel him to be satisfied. . . . He has to satisfy the magistrate of his belief, and he has not done so. Even if the magistrate is wrong, we cannot make him be satisfied."

The rule was discharged.

That is the result when the law gets into the courts, and the real test of a law is a trial in court. Yet more than 200,000 children have actually been exempted under that law, notwithstanding this. Mr. Wallace, notwithstanding, as Professor Sedgwick says, he is a noted scientist, neglects and omits, in his recent work, all reference to the greatest experiment in the world,— the condition of Germany to-day,— simply because it is unanswerable.

The CHAIRMAN.— Is Dr. Brough in the hall?

Dr. HILL.— Dr. Brough asked me to say that he had been called away, and could not speak.

The CHAIRMAN.— Dr. Swartz, of Providence.

Dr. SWARTZ.— Mr. Chairman, I know that you have all got mixed up on this question; but, to come down to the original subject of small-pox, of course we all know it is here with us,— we know it has been with us for some time. We know that in the year 1900 there were about 5,000 cases in the United States, as stated by the Marine Hospital Service Reports; that there were at that time less than 100 deaths, or only 1 per cent. of deaths to the number of cases; that in 1901, instead of their being 5,000 cases, there were 15,000 cases, with some 484 deaths, or 4 per cent. of deaths, which means that the numbers are on the increase, that the percentage of deaths is greater. That means that every one of us, in our individual towns and States, sooner or later may be called upon to answer the question which most of the minds here are asking now, "How shall we know when we have a case of small-pox, and when we have one what shall we do with it?" I think that is what most of the health officers have upon their minds more than anything else as a question at the present time, and would like to have answered. I have had slight experience in the small State of Rhode Island. Al-

though rich in manufacturing wealth and in population, we may not, perhaps, be as rich in small-pox as Massachusetts; but we are reaching our tally very fast. Thus far, since the 1st of January last, we perhaps can report about 175 cases, with six or seven deaths.

The question of the diagnosis is the one upon which we must rest, in the first place; and that has been explained to you quite explicitly, I think, by Dr. Shea. With very little reference to the text-books and the cases which are reported now, I think the average health officer would be able to make a diagnosis between the diseases spoken of and small-pox. It is well, of course, to have one little tab, one pathognomonic spot or point upon which we may rest; and that might be suggested in the form of the papules, for in those cases where vaccination has taken place successfully, and the disease occurs in that person, as it does frequently, we find that the eruption is not distinctive, it is aborted in a measure; and there may not be among the twenty or thirty papules present, or vesicles, more than one or two which are distinctive. The distinction which I have relied upon, not alone from experience, but from instruction from such authorities as Dr. McCollum and Dr. Shea, and others with whom I have had consultation, is the one point as to the superficiality of the vesicle in chicken-pox as compared with the depth of the vesicle in small-pox. In other words, if you look the person over thoroughly, you will find at some place or other a vesicle which may be or may not be ruptured. If it can be ruptured and falls flat to the surface, it may be known to be superficial, and can be diagnosed as chicken-pox. This will be borne out by other diagnostic signs of the fact that there are new vesicles and old scabs upon one and the same person. In small-pox the disease commences and advances with a regularity which cannot be found in chicken-pox; and, if you may successfully rupture a vesicle in small-pox, it will not flatten out upon the surface, but there may be left a corona around the edge of the opening, which will persist and will remain for days, which is quite contrary to the condition of chicken-pox.

Our arrangement in Rhode Island is that, in case of an eruption, whether it may be measles or chicken-pox or some other eruptive disease, that person is guilty of having small-pox until he is proven to be innocent. If the officers, as a whole, would work upon that

rule, and call upon those who are interested in these matters, who are posted upon the conditions which are present in small-pox, the spread of the disease would be more or less checked. Unfortunately, among us we have physicians of foreign parentage, who have come into our borders, who are working among their own people in the mills, and who disguise the fact that they know nothing about the disease. The result is that we have working in our mills to-day, without our knowledge, cases where desiccation is going on, and desquamation, and it is from those cases that we get the spread of the disease.

Knowing that we have the disease, the health officer is responsible for the conditions, and it is there where the seriousness of the matter comes to him, and the one which concerns us more particularly. A rule, perhaps, which one might readily go by is this, stopping to consider the means of the spread of the disease, that from the commencement of the disease up to the time of desquamation — that is to say, during the incubation of the disease, during the vesication and pustulation — the opportunity of disseminating that disease from the patient can exist only from the mouth. It cannot go from the body unless a pustule is broken, and *inoculation* takes place from that pustule. The opportunity for that, of course, is remote among the public. But at the time that desiccation or desquamation commences, at that one point, comes the time when the danger is great to the public. Upon those two points, as to whether it has reached that point or not, rests our position as to whether we shall or shall not establish quarantine upon one or many individuals. Having the case of small-pox, of course, decided, there is no question whatever but the person concerned is to be quarantined. Next comes the question, Who else who was exposed to that shall be quarantined? Of course, with all those who have not been vaccinated, but who have been exposed by mouth exposure, as is the case in families, where they are closely related, the danger is very great. With those who may have been working with a person during that time the danger is very slight up to the time of desquamation. I think, basing action upon that rule, or remembering that, it would help out the average health officer who has not had experience and who is very apt to have it to-morrow,— without any desire for it, perhaps,—

that he may be able to determine his methods of procedure. In other words, a number of persons exposed to a person who is just coming down with the disease, but is not desquamating, should not necessarily be quarantined: they may be watched from day to day for fourteen days, after being thoroughly vaccinated; and, as Dr. Durgin has said, those who refuse to be vaccinated, and have been exposed, should be quarantined for the fourteen days, to show that they are no longer suspects. But those who have been exposed to a case where desquamation has taken place and have been in close contact with the patient? It seems to me necessary and desirable that every one of those should be quarantined, no matter if they are vaccinated, until the vaccination takes in a thorough way or until the fourteen days are past.

It is those little problems that come to the health officer which give him the puzzle and the position which is undesired. Upon the one hand, if he makes a mistake and quarantines too many people, incurs too great an expense, he has the town officers upon him, he receives disgrace from the public in that way: whereas, if he is too negligent in allowing people to go abroad and has more cases occur, he is bound to be complained of in that way. That is the opportunity — in fact, the privilege — of the health officer, to be blamed upon either side. But, having accepted that position, of course it is policy to act upon the best data which we have at hand; and even with the best in those cases there will be mistakes. Fortunately, in this State, as in some other States, those who are in doubt in such cases have the possibility of calling upon an authorized health officer, who can give assistance in this matter, and clear up and take from the ordinary health officer the excess of the discomfiture which would result.

The CHAIRMAN.— Mr. Coffey, of Worcester.

Mr. COFFEY.— Mr. Chairman, I don't know that I can add anything to this subject. It has already been thoroughly threshed out. I feel somewhat like the proverbial fifth wheel to the coach,— that I am unnecessary. But, perhaps, for some of the health officers here I might detail our experiences in Worcester when we have had small-pox, as it might be an aid to them in handling the disease.

During my eighteen years' service as executive officer of the Worcester Board of Health we have had six outbreaks of small-pox. During that time no child has contracted the disease, except in one case, an infant, who had never been vaccinated. The outbreaks have always occurred among and been confined to adults: we have never had a case of small-pox among children of school age who have been vaccinated. That in itself, it seems to me, is pretty good evidence in favor of vaccination.

We do vaccination, perhaps, more on the wholesale in Worcester than in any place that I know of. Our chairman, Dr. Clark, every Monday during the year is at the office of the board, and vaccinates the school children. We vaccinate in the course of the year something like from 2,500 to 3,000 children. While the law requires that children who shall be certified by the school department to the Board of Health as being unable to pay for vaccination shall be vaccinated, — while that is the law,— we have ignored that portion of the law in Worcester; and we vaccinate all who come, without asking any questions. Consequently, a great many people appear with children who, perhaps, can well afford to pay for vaccination to the regular physicians; but we have felt that the sanitary good that is derived from the thorough vaccination that we know we do more than offsets the cost and trouble of vaccinating those children. Dr. Clark instituted, some years ago, the practice of having two trained nurses from the City Hospital come to the office of the board every Monday morning; and there they prepare the arms of the children by washing first with a liquid soap, and afterwards with alcohol, and then the children are vaccinated. We vaccinated during the past summer something over 8,000 people. We never have any trouble with sore arms, never have any children come in or any parents come in finding any fault with the vaccination since this practice has been instituted.

In the outbreak of 1894 we had some twenty cases. At that time we abandoned the use of flags and the quarantining of houses. When a case of small-pox is reported, we take the person out just as quickly as possible. After he is taken out, as a general thing, I have men there ready to enter the house and disinfect. They are waiting frequently for the man to be taken out; and they enter imme-

diately, and the house is thoroughly disinfected. Everybody who has been exposed in any way to the patient is vaccinated. Then every morning for two weeks one of our inspectors visits that house, and sees every person in it, and learns if there is anybody ailing in the house. That is all. We don't lock anybody up. We don't put any policeman at the door. We let them go and come. Now, that has got to be modified, of course, by the circumstances. It may be that you would have a case of small-pox among a lot of Italian laborers, upon whom you could not depend. Then, of course, you would have to adopt different methods. But, as a rule, among the settled persons in the community, you will find — or at least we have found — that that method is efficacious; and we have had no difficulty in stamping out the disease.

Last summer we had an outbreak in the City Hospital at Worcester. A patient got in there suffering with what was supposed to be chicken-pox: it later turned out to be a mild case of varioloid. From him several others contracted the disease. One of them was one of the house officers of the City Hospital, a young physician, who was just ready to start out in his life-work, and who, unfortunately, lost his life. We had in all ten cases. Of those ten cases there were four deaths,— quite a heavy mortality; but of those four the only one who was said to have ever been vaccinated was this young physician, although no scar could be found on him which would indicate that he was successfully vaccinated. The other three there was no question about at all: they never had been vaccinated. Two of them died within forty-eight hours after being taken with the disease. When we drove up to the house to take one patient, a colored fellow, into the ambulance, he ran down the stairs and jumped into the ambulance as lively and as frisky as any man in perfect health. That was at noon on Thursday, and at 4.30 on Friday afternoon he was dead with hemorrhagic small-pox. Another patient, an elderly man, died with hemorrhagic small-pox within forty-eight hours after his committal to the hospital.

With those cases in evidence, I cannot understand, as a layman, how anybody can disbelieve in vaccination. It is the only protection we have, the only protection that our officials and our men have about the department. None of our men, with one exception, has

ever had the disease, and yet they go in and handle it, and handle the dirty clothing and disinfect the house; and the only protection, as I say, is vaccination. Every time there is an outbreak we are all vaccinated, and that is our only protection.

We have been singularly fortunate in Worcester, and we are congratulating ourselves upon the fact that, notwithstanding that we are the second city in the Commonwealth, we have had since last July only one case of small-pox; and that was about five or six weeks ago, and the patient has since been discharged. At present we have no case there, and have not had anything since that outbreak in the City Hospital.

I think, on the whole, as I said before, that a great deal of this feeling and prejudice against boards of health could be obviated if the health boards and the officials would be a little less panic-stricken and would take care of the disease in the way in which I have mentioned. I have read about some towns where everybody seems to have lost his head, and they have armed guards, house guards, on duty night and day; and they feed the people with a pole through the windows. It seems to me, and I have often thought when reading accounts of that kind, that those things tend to bring health departments into disrepute. The thing might be just as easily handled, as we have found that we can do it in Worcester, in the way that I have described, and which was also described by Dr. Swartz. Of course, as I said before, you must use your common sense. You must fit the conditions to the circumstances; but, as a rule, you will find that, if you do as I have described, you can easily stamp out the disease, at the minimum of expense and without creating any panic in the community.

Mr. Nye.— I should like to ask Mr. Coffey if he will explain the methods he uses in disinfecting.

Mr. Coffey.— I confess that I am still a believer in the use of sulphur, and we are using sulphur largely. In fact, in small-pox cases, I stick to sulphur almost exclusively; and we have never had a recurrence in any house that we ever disinfected. We have never had another case of the disease after we got through fumigating with sulphur. About that, too, you must use your common sense. There are some houses where they insist on formaldehyde, where they know

about it, and where they insist upon it, and where the conditions are such that perhaps sulphur might be damaging to fabrics and to the furniture of the house. If that is so, then you will have to use the formalin. We have both; but, as a rule, I have stuck to sulphur,—sulphur with the moisture added,—and we never have had a single case of disease break out after we have got through fumigating or disinfecting.

Mr. Nye.—I should also like to ask what you are in the habit of destroying about the house, if you destroy the bedding and clothing.

Mr. Coffey.—Not as a rule, no. We turn them up and get them as fit for allowing the fumes to get about in every way as is possible, and we don't destroy anything unless it is so filthy that it really ought to be destroyed. We don't destroy, never have destroyed, any furniture.

Mr. Nye.—In the case of a carpet on the floor which was in bad shape, would you allow that to remain on the floor?

Mr. Coffey.—No, they take it up and disinfect it with the rest. We went into this house that I speak of, the home of the colored man previously mentioned as dying so suddenly, soon after his removal to the hospital. That was the average colored man's house, with all that that implies,—the poor colored man; and we did not destroy anything there: we thoroughly disinfected it and scrubbed it. We used in addition to the sulphur a solution of corrosive, and scrubbed the woodwork, floors and furniture; and we did not have any other cases in the house among them, although some of them had not been vaccinated since infancy.

Mr. Nye.—The clothing of assistants, etc., it is not necessary to destroy?

Mr. Coffey.—No, the clothing of the patients that has been worn we leave in the rooms to be disinfected with the other articles. Our men use a gown and a cap when they go in. The gown goes to their feet. It is a gown such as is used in contagious hospitals, as perhaps you know,—a long, loose gown, which buttons in the back and about the wrist; and the cap is one that comes down over the hair. I have had them put that on, and, as soon as they got through, roll it up in a bundle. I got some large paper bags that I bought at a store; and, as soon as they got through, they would thrust the gown

and cap into a paper bag, and seal it up and bring it back to the office. Then I had a strong solution of corrosive made there in a large vessel, and the bag and contents was thrust down into it, paper and all; and the paper was opened under the water. They laid there for twenty-four hours, and we took them out and dried them.

The Chairman.— Is there anything else to be said upon this question?

Dr. French.— Just one thing. I won't attempt to go over any of the ground that has been gone over so thoroughly, but it strikes me that there is just one point that has not been touched upon. The evidence here is so strong, it seems to me, that with us there is but one side of the question; and it occurs to my mind if we are not, as a body, pretty easily satisfied. We are going up to the State House to-morrow to try to combat the evil influences that we think the anti-vaccinationists are exerting. I think on one point that we could take lessons from the anti-vaccinationists; that is, we should be as persistent in carrying out what we think ought to be done as they are in what they claim they think ought to be done. We should do more work. I believe every man here believes in vaccination and in vaccination laws, but I question if any of us are satisfied with them. They ought to be more thorough, they ought to be more rigid, and we ought to see that everybody is vaccinated; but we are not making any endeavor to make our laws more thorough. I believe that we should have the courage of our convictions. Instead of going up there and combating that,— perhaps it may be too late this year,— we should work ourselves up to the courage of recommending laws that we believe are more effectual than what we have now, so that the people who make laws would begin to think we are in earnest, and would be considering the other side of the question.

The Chairman.— I should like, at the end of this discussion, to mention one point which has not been fully stated and is at the bottom of the whole difficulty; and that is the lack of thorough vaccination where it is attempted. It is well known that people are operated upon for vaccination, and, whether it "takes" or not, they are reported as vaccinated and supposed to be protected; and in a large percentage of such cases there is no protection given, in another

large percentage the protection is but partial, and the doctor has failed to complete his duty. The more we bear this in mind, the better it will be for our side of the question. It is a well-known fact that we are having too many cases of small-pox among the vaccinated, who are thought to be immune. We would not have this if we began in infancy, and vaccinated until the susceptibility of the child was exhausted. This can and should be done, to start with. When the time comes for revaccination, which ought to be at ten or twelve years of age at the latest,— and I get many successful revaccinations at six or seven,— I say at that time we should repeat this operation with the same faithfulness and persistency that we did in the first place, and exhaust any and all susceptibility to small-pox that may be found in that child at that time, and subsequently on exposure or other necessary occasion for revaccination. Were this done, our friends on the other side would have less to say about small-pox among the vaccinated. Does any one else desire to speak on this question?

Dr. Osgood.— I have a few questions I would like to ask. Dr. Shea has gone, but perhaps some one else can answer these questions fully as well. I wish to ask the comparative frequency and the gross pathological lesions in cases of death from small-pox before the eruption has had time to appear. I should also like to ask the relative value of glycerinized lymph, dry lymph, and humanized lymph, in cases where we vaccinate people who had been exposed to small-pox perhaps two or three days previous. I should also like to ask the question as to whether this present flurry of small-pox in Boston has been characterized by an appearance of those mild cases which physicians reported in 1897 and 1898 as having appeared in Alabama, Tennessee, Kentucky, and other Southern and Western States, and which could hardly be recognized.

The Chairman.— I would say in regard to the first question that the pathological conditions observed have in this epidemic been confined to the studies of Professor Councilman, whose results I should be unable to state. In regard to the vaccine lymph, while we have used both the dry and the glycerinized wet points, we are not in a condition yet to say very much as to conclusions. We have used most largely the glycerinized wet points, which are sealed in paraffine.

They have been convenient, and, so far as we have observed results, effective and cleanly. As to the third question —

Dr. Osgood.— In regard to mild cases of small-pox.

The Chairman.— As to the mild cases. Early in the season there were quite a large number of those extremely mild cases. They appeared more like chicken-pox; and many were overlooked by the attending physicians on that account, and some were overlooked by even the patient himself. I saw quite a few who were at work, feeling as healthy as ever; but certain conditions led to a suspicion, and a large number of people were examined, and some were found at work in a large shop among others. But later in the season the disease has been more serious in its appearance and character.

Dr. Osgood.— I do not think that you fully understood my second question. It is considered by many that glycerinized lymph is slower in its action than dry points. Welsh, of Baltimore, thinks that the humanized lymph is quicker in its action than either. In cases of vaccination where delay is dangerous, after a person has been exposed, say, to small-pox for two or three days and we first see him then and vaccinate him at that time, whether one form of lymph is superior to others?

The Chairman.— I am inclined to think, from former observations, that the dry point has been quicker in result than the glycerinized lymph. I would not like to state this as a positive conclusion, but I have felt somewhat impressed with that fact. As to the quicker result from the humanized virus than that from the bovine, I am thoroughly convinced personally that it is a fact; and from arm to arm would give the quickest of all. In many instances the person needing immediate vaccination is not found until two, three, or even four days after the exposure, when time is of great moment in getting in your vaccination. I would say in this connection, also, that in the Republic of Mexico almost nothing is used but humanized lymph; and they tell me that they do not revaccinate, and that they never have cases of small-pox among the vaccinated. That has been going on for about one hundred years. This humanized lymph which is used in Mexico was brought from Europe in 1800, and during this hundred years has been propagated and dispensed by only four persons, who have been appointed by the government to take charge of the virus and to provide it in the best condition.

Dr. Osgood.— One more question, and I am through. What are the dangers of infection in autopsies on cases of small-pox, when they die prior to the eruptive stage?

The Chairman.— I could not answer that. The hour being late and parties waiting impatiently, a motion to adjourn will be in order.

Adjourned.

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J. A. Magee, M.D.
George W. Smith.
Emil C. Stiegler.
J. F. Winchester, M.D.

Leominster.

C. E. Bigelow, M.D.
H. N. Spring.
A. L. Whitney.

Lexington.

George O. Whiting.

Lowell.

James B. Field, M.D.
J. Arthur Gage, M.D.
Thomas F. Harrington, M.D.
H. H. Knapp.
W. P. Lawler, M.D.
J. N. Marston, M.D.
Thomas B. Smith, M.D.

Lynn.

W. E. Holbrook, M.D.
W. A. Woodfall, M.D.
R. E. Hillard.

Malden.

Frank H. Parker, M.D.

Marlboro.

F. F. McCarthy, M.D.
William S. Richardson, M.D.

Melrose.

William H. Dole.
Clarence P. Holden, M.D.
Paul H. Provandie, M.D.

Milton.

Thomas K. Cummings.
Walter C. Kite, M.D.
Charles S. Minot, M.D.
Samuel D. Parker.

Needham.

A. E. Miller, M.D.
A. M. Miller, M.D.

New Bedford.

J. T. Bullard, M.D.
Thomas W. Cook.
Edgar H. Gammons.
W. S. Kirschbaum.
Louis H. Richardson.
Manual V. Sylvia, M.D.

Newport, R.I.

Joseph W. Sampson.

Newton.

S. W. Abbott, M.D.
J. C. Brimblecom.
Francis G. Curtis, M.D.
George H. Ellis.
W. F. Harbach.
Arthur Hudson
A. Stanton Hudson, M.D.
Henry A. Stone.
E. R. Utley, M.D.

New York City.

Col. W. F. Morse.

North Andover.

Charles P. Morrill, M.D.

North Brookfield.

T. J. Garrigan, M.D.

Norwood.

Lyman F. Bigelow, M.D.
Eben C. Norton, M.D.

Palmer.

S. O. Miller, M.D. (Three Rivers).
J. P. Schneider, M.D.

Plymouth.

W. G. Brown, M.D.

Providence, R.I.

Ernest T. Badger.
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Gardner T. Swarts, M.D.

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J. C. Batchelder, M.D.
Gilman Osgood, M.D.

Salem.

G. Lincoln Allen.
C. A. Ahearne, M.D.
G. Arthur Bodwell.
J. A. Fitzgerald.
Charles B. Fowler.
W. H. Gove.
Morgan McSweeney
Raymond L. Newcomb.
William O. Safford.
A. N. Sargent, M.D.
B. R. Symonds, M.D.
David P. Waters.

Somerville.

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A. E. Merrill, M.D.
A. R. Perry, M.D.

South Framingham.

L. M. Palmer, M.D.
W. N. Sharp, M.D.

Springfield.

A. L. Brown, M.D.
W. H. Chapin, M.D.
Herbert C. Emerson, M.D.
James Kimball.
B. D. Pierce, D.V.S.
J. C. Rausehousen.
S. J. Russell, M.D.

Taunton.

W. Y. Fox, M.D.
Charles H. Macomber.
T. J Robinson, M.D.
Edward J. Shannahan, M.D.
Elliott Washburn, M.D.
Henry H. Wilcox.

Turner's Falls.

P. F. Leary, M.D.

Waltham.

H. D. Chadwick, M.D.
C. J. McCormick, M.D.
Marshall J. Mosher, M.D.
E. Irving Smith.
Charles A. Willis, M.D.

Watertown.

Sumner Coolidge, M.D.
Vivian Daniel, M.D
Julian A. Mead, M.D.

Waverley.

L. B. Clark, M.D.

Wellesley.

Edward Bancroft, M.D.

Westboro.

Francis E. Corey, M.D.
C. S. Henry.

Westfield.

James W. Holland, M.D.

Weston.

George Abercrombie.
F. W. Jackson, M.D.
S. Sanford Orr, M.D.

Whitman.

C. E. Lovell, M.D.

Winchendon.

F. W. Russell, M.D.

Winthrop.

A. B. Dorman, M.D.
Horace J. Soule, M.D.

Woburn.

Fred J. Brown.
George Buchanan.
James H. Conway, M.D.

Worcester.

F. H. Baker, M.D.
George W. Batchelder.
W. T. Clark, M.D.
James C. Coffey.
Prof. L. P. Kinnicutt.
J. F. McCartney.
L. F. Woodward, M.D.

Minneapolis, Minn.

F. F. Wesbrook, M.D., Honorary Member.

JOURNAL OF THE

Massachusetts Association of Boards of Health.

ORGANIZED 1890.

[The Association as a body is not responsible for statements or opinions of any of its members.]

Vol. XII. July, 1902. No. 2.

APRIL MEETING

OF THE

Massachusetts Association of Boards of Health.

The April meeting of the Massachusetts Association of Boards of Health was held at the Parker House, Boston, on Thursday, April 24, Dr. Samuel H. Durgin, Vice-President, in the chair.

On motion of Dr. Hibbert W. Hill the records of the January meeting were taken as read.

Mr. Coffey, Secretary, submitted the following names of applicants whom the Executive Committee recommended for membership in the Association: —

T. J. Collins . . . . Springfield
Fredson N. Grey . . . . Leominster
R. A. Elliott, M.D. . . . . Avon
E. P. Linfield . . . . Avon
William H. Kelliher, M.D. . . . . Woburn
Dennis G. Doherty . . . . Woburn
John Timlin, M.D. . . . . Melrose
James H. McGrath . . . . Clinton
F. T. Hyde, M.D. . . . . Weston
A. W. Draper, V.M.D. . . . . Milton

On motion of Professor Sedgwick the ten gentlemen named were elected members, the Secretary casting one ballot for them.

The Chairman.— We have with us to-day the kind of gentleman that we frequently look for on these occasions. I have the pleasure of introducing Mr. Edward R. Warren, of Boston, who will read a paper on "Smoke Nuisance."

THE RESULT OF IMPERFECT COMBUSTION OF FUEL.

BY MR. EDWARD R. WARREN.

The most apparent and serious result of imperfect combustion of fuel is the commonly known smoke nuisance, an evil far-reaching in its consequences and one which many of the large cities of the world are striving to conquer. It is especially appropriate that this matter should be brought to your attention as members of the boards of health of the cities and towns of Massachusetts, from the fact that the citizens of this Metropolitan District have come to realize the necessity of taking active steps through your co-operation toward abolishing this serious nuisance which is every day growing worse. Until within recent years Boston has always been a bright, cheerful, smokeless city; but, with the introduction of bituminous coal as a cheap and economical fuel, these conditions have unfortunately materially changed.

The smoke nuisance may be found in its most aggravated form in Pittsburg, Cleveland, and other of our Western cities, as well as in the great manufacturing towns in England. It owes its existence chiefly to unintelligent, careless, and wasteful use of bituminous coal and other fuels, which, if properly burned, are both efficient and economical.

Until recently it has been considered a necessary evil, and little attempt was made to find a remedy; but, with the enormous growth of manufacturing in cities and the consequent increase in consumption of coal, the smoke conditions have become so intolerable that at last strenuous efforts are being made to abolish the nuisance.

Ingenuity first expressed itself in repeated endeavors to find

devices for consuming smoke, but these attempts met with comparatively little success; and means of smoke prevention were sought, which have proved from every point of view to be the wise and proper solution of the problem. The old saying that "an ounce of prevention is worth a pound of cure" certainly applies in the case of a smoke nuisance. This reform deserves the active moral support of all who have the welfare of the community at heart, and only through unselfish co-operation can it be successfully accomplished. An adequate law for the suppression of smoke is of course necessary, with proper provisions for penalty in the case of repeated violation. But experience shows us clearly in the examples which we have in other cities of the world that, after all, the best results may be attained by an exercise of moral suasion and gradual educational training; and it therefore seems appropriate and wise that the direction of this work should be under the control and guidance of boards of health under whose charge all similar nuisances are placed.

Whether or not an atmosphere heavily laden with smoke and soot is directly injurious to health, in the form of disease, it must at least have an indirect effect, as a result of uncleanliness, dampness, and want of sunshine and cheerfulness. It may reasonably be claimed that mental and consequently physical condition is impaired under such depressing influences.

A distinguished London physician, who has made a careful study of the question from a standpoint of health, claims that the smoke produced from the burning of certain bituminous coals is highly charged with sulphur, which, coming in contact with a moist atmosphere, produces sulphuretted acid, which is one of the most insidious irritants of the human system.

Fortunately, aside from the moral and æsthetic reasons why the prevalence of smoke is a detriment to the common interests, a very important consideration is the economic advantage of smoke prevention; and those who cannot be appealed to from public spirit may be influenced by a convincing demonstration that it is to the pecuniary interest of the consumer of coal to prevent smoke. For smoke implies imperfect combustion, with a consequent loss in heat units from the escape of unconsumed gases and carbon. It is estimated

that frequently the loss of fuel from careless firing is from 15 to 25 per cent. It is also fortunate that it has been proved by experience that bituminous coal and other smoke-producing fuels may be burned properly and economically without the employment of expensive mechanical devices for smoke prevention if reasonable care is taken in the construction of the furnaces and grates and if faithful and skilful firemen are employed.

In this connection it may be well to say a few words concerning the smoke problem as we find it successfully solved in the city of Berlin, where for sanitary, æsthetic, and economic reasons the most careful attention and study has been given to the prevention of smoke. The city has a population of nearly two millions and a half, and is equally important as a beautiful residential city and as a manufacturing centre. One-third of its business interests are manufacturing, although the coal-mining districts are remote, which necessitates the transportation of fuel from a distance. In 1900 there were 1,351 manufacturing establishments in Berlin; and during this same year the total consumption of coal was nearly 3,000,000 tons, all of which, with the exception of 80,000 tons of anthracite, was a low grade of bituminous coal.

The clear atmosphere of Berlin is chiefly due to excellent management on the part of the city authorities and to efficient police control. Expensive mechanical devices, such as automatic stokers, down-draft furnaces, and patent grates, are used in Germany to some extent; but they are not considered essential, as it has been found that practically as good results may be attained by faithful and intelligent hand-firing. It is not enough that a man should be able to shovel coal to make him a good fireman; but, unfortunately, this seems to be too often the standard of excellence in the United States. It seems strange that with all the economies which are necessarily practised in manufacturing to-day, as a result of competition, that economy of fuel has been so carelessly overlooked and so recklessly neglected. If the consumer of coal is saving from two to three dollars a ton by using bituminous coal in place of anthracite, he seems content with this economy, which requires no ingenuity and little thought, and burns the bituminous coal so wastefully and unintelligently that not only does he cause great annoyance and

discomfort to his neighbors, but a direct loss to himself of from 15 to 25 per cent. in fuel. A proof of this enormous loss may be used by the advocates of the abatement of the smoke nuisance as a sufficient argument, leaving out of consideration the higher motives.

In the United States our coal supplies are so enormous and so varied that we scarcely realize the important part which economy plays in other parts of the world where fuels are less abundant, and consequently more expensive. The inferior qualities of soft coal which are used in Berlin cost from five dollars and a half to seven dollars a ton delivered at wholesale. They are all of a much lower grade than the ordinary Nova Scotia coal; and, unless they are carefully burned, they produce much smoke. Two-thirds of the anthracite coal used in Berlin is imported from England, and costs at retail from ten dollars to twelve dollars a ton. It is therefore easy to see the relation which economy bears to the smoke problem in Berlin. The dependence upon hand-firing in Germany has led to the establishing of schools for the training of firemen, and this is one of the best smoke lessons which Germany has to teach us. These schools for a nominal fee of from two to three dollars afford two weeks' instruction in the art of firing and the care of boilers. In Prussia there are seven of these schools, and there are many others in other parts of Germany. The men so trained are greatly in demand, and it is a very interesting and significant fact that these training schools have been the direct means of raising the standard and wages of firemen in Germany. Why should not some such wise provision for teaching the art of firing be undertaken in this country? There are many of the smaller boiler plants in manufactories and apartment houses in which, with reasonably well-constructed furnaces, soft coal might be used without causing objectionable smoke if ordinary intelligence were employed in the care of the fires. Such firemen would deserve good wages, which the employer could well afford to pay, since, as a consequence of this intelligence and care-taking, the saving in coal would be a substantial item.

It is worth repeating that with a great amount of smoke there is a correspondingly great loss in heat units. Smoke is caused by the generation of gas and hydro-carbon, which are liberated from the coal at a temperature below that which is required for combustion.

This unconsumed material passes through the chimney largely in the form of soot. The principle of good firing is a very simple one. If the surface of a fire is thickly covered with fresh coal, the temperature of the furnace is suddenly lowered, combustion is arrested, and gases are formed which the heat is not sufficient to ignite; and, consequently, the draft causes them to pass over the fire-bridge into a lower temperature, which converts them into smoke and soot. This may be easily prevented by taking care, before firing, to push forward the incandescent mass toward the bridge and to add a moderate amount of coal, placing it within and near the furnace door, where it may gradually heat and coke. When it is in a condition for combustion, it should be pushed forward and spread over the surface of the fire.

The most common and wasteful practise of careless firing is in applying too much coal at a time, and, what is still worse, in throwing in the coal upon the hottest part of the grate. The true secret of good firing is to furnish uniform air supply, and to add small amounts of fresh coal at frequent intervals.

In the English cities the difficulties to be overcome are much greater than ours. This is principally due to the fact that the domestic use of bituminous coal is largely responsible for the smoke. It is much more difficult, and, in fact, impossible, without the greatest care, to prevent smoke arising from the open fires and kitchen stoves. In such cities as Birmingham, Manchester, and Liverpool the conditions have become so hopelessly bad, with the combination of smoke from boiler plants and domestic fires, that any attempt at improvement meets with great discouragement. Some progress, however, has been made, especially in Manchester. In London, where the conditions are much better, there has been considerable activity, especially during the past few years. It is claimed that the presence of smoke in the atmosphere is to a great extent the cause of the London fogs. Sir William Thiselton-Dyer has been conducting experiments during some of the recent fogs, and has found that in a week six tons of solid matter, consisting of soot and tarry hydrocarbons, were deposited on one square quarter of a mile; and he asserts that this matter is injurious both to animal and vegetable life.

The experts who are at work in London are hopeful that with the

further suppression of smoke from factories and more care in the homes the densest fogs may be prevented.

Sir C. A. Cookson, in a lecture before the Royal Institute of Public Health, stated that, so far from the evil being desperate, the remedy lies in the hands of London housewives. The Coal Smoke Abatement Society of London, which since 1898 has been under the guidance of Sir William Richmond, R.A., reports great improvement in fogs during the month of November, 1900, which, it is claimed, was due to a reduction of smoke as a result of the persuasive influence of smoke inspectors. At a meeting of the society was exhibited a marvellous atmospheric deposit which was taken from the cornice below the dome of St. Paul's Cathedral. It is estimated that it had probably taken two hundred years to form. An analysis showed that in one hundred grains there was one grain of carbon and one-half a grain of a tarry substance, chiefly gypsum or crystallized sulphate of lime, produced by the action of the sulphuric acid of the city atmosphere on the carbonate of lime of the building stone. This sulphate of lime is first dissolved by and then deposited from the rain-water, and during its formation it is mixed with the soot. Sir William Richmond has estimated that 6,000 tons of coal are daily carried away in the atmosphere from the chimneys of London.

Turning our attention to what is being accomplished in cities in this country, and to the wide-spread interest which is being taken in this important reform, we find the city of Cleveland in the lead; and the progress which has been made is remarkable. After compulsory smoke abatement had been repeatedly tried in Cleveland, without success, it was found necessary to form an Anti-smoke Nuisance Society, which adopted the policy of gradually educating the consumers of coal, showing them the economic advantages of good stoking and perfect combustion. Good anti-smoke laws were passed; and, with constant effort, the conditions in Cleveland have been much improved. With the co-operation of the municipal association, an important amendment to the statute law was effected in 1900, which created a separate department of the city government, having for its sole function the care of this reform. Professor C. H. Benjamin, the most prominent expert in the United States on this

subject, was appointed supervising engineer; and the whole matter has come under his charge. Not only has the work been successful in effecting improvement in stationary plants, but it has also accomplished most encouraging results in suppressing the smoke from the locomotives of the railroads, which in such a railroad centre as Cleveland is a most important factor. In spite of great opposition Professor Benjamin has gained the confidence of the people, and has convinced them that the enforcement of reasonable anti-smoke legislation rather than opposing the manufacturing and commercial interests is a benefit to them; and the Chamber of Commerce has given its approval to the movement.

St. Louis is also taking active steps; and it was recently reported at a meeting of the Citizens' Smoke Abatement Association that 310 steam-jet and air-blast furnaces had been installed, 113 down-draft furnaces, 35 brick arches, and 7 automatic stokers, a total of 466 smoke-abating devices.

For many years Chicago has been trying in vain to solve the smoke problem, at first with a view of finding some form of smoke consumer, which is now generally acknowledged an unsuccessful method. They have since been working in the direction of smoke prevention with more hopeful results; and it is reported that automatic stokers and other devices have been installed in no less than 354 buildings, and that scarcely any smoke is emitted from their chimneys. These cases which have been cited are cities in which the smoke nuisance has gained tremendous headway, which makes any change for the better very difficult.

In the Eastern cities, in which the use of bituminous coal is but a recent innovation, the question is a defensive one; and with reasonable precaution it is quite possible to prevent the evil from spreading, and it is further possible to cure it. As a proof of this, we have a shining example in New York City, where the control of the smoke nuisance has for many years been in the hands of the Board of Health. Although the law is exacting, and provides that the discharge of smoke, cinders, soot, and dust, is declared a nuisance and shall not be permitted, the enforcement of this law is so justly and reasonably administered that it has not proved a hardship to the community. Having with us to-day an inspector of the New York

Board of Health, he will tell us in detail how the law is enforced. Suffice it to say that the Board of Health has gained the confidence of the community, that its best smoke inspectors are the people themselves, which is a co-operation of forces which is most desirable and effective.

With the law so enforced by an autocratic and discretionary board, the danger is eliminated of political influence, which may naturally arise from the employment of smoke inspectors under the control of a city government. It is also proper that this nuisance, as all others are, should be in the care of boards of health. The atmosphere in the city of New York is clearer and freer from smoke than it is in any other large city in the world where such enormous amounts of bituminous coal are consumed. A smoking chimney is an exception, and yet more soft coal is burned annually in New York than in Boston.

It is unfortunately true that up to the present time we have treated this important matter with indifference. From time to time laws have been passed, which have never been accepted by our town and city governments. Inspectors, it is true, have been appointed; but, either from want of ability or proper direction, they have never been able to suppress the smoke to any desirable extent.

It is proper to call to your attention, as members of the boards of health of the State of Massachusetts, that our committee has given this subject careful study at home and abroad, comparing our conditions in Boston and its vicinity with those which exist in cities where the subject has been carelessly neglected, as well as with those where systematic effort and public spirit have been the means of abolishing the smoke nuisance to the benefit of all concerned. These investigations have led us to believe that immediate action is necessary; and, profiting by a good example, the bill which is now before the legislature has been carefully drafted on the same lines as the New York City law, which places the control of the smoke nuisance in the hands of the Board of Health. A very important feature of the bill is that it provides for a Metropolitan District, an area which includes the city of Boston and all cities and towns in whole or in part within a radius of ten miles of the State House. The act is legislative rather than local or municipal. The necessity

of this provision is obvious. In consequence of the free circulation of smoke from one locality to another the law should take effect simultaneously, and it would seem unwise to provide that it should be optional upon the part of each city and town government to accept or reject it.

It is hoped that this bill will be enacted during the present session of the legislature, that its enforcement by the boards of health may result in the abatement of the smoke nuisance within a reasonable time, and that, as a result, it may lead to the adoption of like measures by the governments of other cities and towns in the Commonwealth.

The Chairman.— The discussion will be opened by Professor Sedgwick.

Professor Sedgwick.— Mr. Chairman and gentlemen,— after Mr. Warren's very clear and excellent paper, it is unnecessary for me to go into much detail on this subject. Boston and the vicinity have a smoke nuisance. Some people say they have not; but, if you will watch from the top of any building in this city for a little while at any time of day, you will see a number of chimneys pouring out dense black smoke, and at certain times, when the atmosphere is quiet, you can see this same phenomenon with the greatest ease. You will find, moreover, that it is not confined to Boston, but that the chimneys in Cambridge and in Somerville, and I dare say in other suburban towns of the Greater Boston, are doing the same thing.

Now how has this come to pass? It has simply been due to the introduction of soft coal. Some have said, "Well, then, why not stop the use of soft coal?" It is not believed that that would be judicious or wise. Soft coal is splendid manufacturing fuel. It is cheap. It has high heating-capacity. It burns freely. And it has undoubtedly, in my judgment, come to stay. We are bound, then, I think, to have soft coal; and the question is simply, Shall we allow Boston to become a Chicago, a Cleveland, a Cincinnati, or a Pittsburg, or shall we keep it, as it always has been, a region of clear skies, pure air, beautiful buildings, and pleasant to live in? Some will say, "Well, we never shall burn enough soft coal to do any great harm"; and they will point out with justice that the trouble in London

is largely due to the fact that the householders, in their kitchen fires, burn soft coal. That is true in London; but it is not true here, and is not likely to be at present. The people have become fond of and used to hard coal in houses, they have stoves that burn hard coal, and it would be a hardship if they were obliged to turn over to burn soft coal. I do not think that that danger is imminent.

The question is, then, Shall the chimneys which are used for power plants, apartment houses, hotels, and the like, be allowed to burn soft coal in any way they please? A number of us believe that they ought not to be, and that now is the time to stop it; and we believe, furthermore, that there is no hardship in compelling them to burn soft coal intelligently. What does that mean? It means for small plants that they shall use intelligent firemen. They may have to pay twenty-five or fifty cents a day more to the firemen in some cases, in order to get a man of intelligence and a man who is not merely a thrower-on of coal. How does it work to-day? Simply like this: The fireman comes round in the morning; and the fire is low, perhaps. He throws on a lot of coal at once upon the hottest part of the fire, reduces the temperature of the whole fire. It smoulders, and the chimney belches forth black smoke, which is not merely smoke, but has a lot of soot mixed with it. Then he gets up his fire, and takes his morning paper, perhaps, and sits down to read; and, getting interested in the daily story, or the latest crime or sensation or political event, whatever it may be, he forgets his fire for a little while, and goes on reading. Suddenly he wakes up to the fact that the steam has gone down, the fire is going down; and he thereupon throws in another big dose, and then comes out a lot more of smoke. That is what we mean by unintelligent firing. It is perfectly demonstrable that with perfect firing you can burn soft coal without smoke, providing you have sufficient grate-bar capacity, sufficient draft and throat of chimney, and sufficient height of the chamber above the fire.

Now, to show the state of things in Boston, I want simply to pass around some pictures which were taken last year by one of my assistants, Mr. Underwood, whom you know very well, the man who has talked to you on mosquitoes, and who has talked to you on the Cambridge marshes, a member of the Board of Health of Belmont, and

one of the brightest men we have in the Association. I got Mr. Underwood, last year, to study up this problem and take some photographs. We will begin, if you please, with his own manufacturing establishment down on Fulton Street; that is, the William Underwood Company, where they pack the devilled ham that you have often bought when you go on picnics. It has a red devil on the top of the little can. It is one of the important manufacturing industries of this State, but not, of course, one of the biggest. They burn two or three tons of soft coal a day there, and they have an intelligent fireman. They have sufficient grate-bar capacity and throat of chimney and draft and so on; and what is the result? The result is that there is no smoke. Here [exhibiting a photograph] is the chimney, this one in the middle of the picture, and no smoke is coming out. Mr. Underwood went and photographed that unknown to the fireman. Then he went to the fireman, and asked him to stir up the fire, and put on coal, and make all the smoke that he could by ordinary stoking, while he went out and took a photograph; and, when the man did that, and stirred things up a good deal, he got that amount of smoke [exhibiting another photograph]. That was all he could get out of it, doing his worst, because he had sufficient grate-bar capacity and draft and mechanical arrangements,— purely mechanical: I don't mean mechanical stokers or anything of that kind, but had things built as they should be. That lasted less than three minutes, and at the end of two minutes that was all the smoke there was coming out [exhibiting another photograph]. That was doing his worst in a hand-fired place, with an ordinary arrangement, not specially adapted to prevent smoke. And that shows that smoke need not come out of small plants, provided they are rightly built, and provided there are right people in charge.

But there are plants in this city which are not intelligently fired, and here are some of them. There is the stack of Houghton & Dutton, which you have seen smoking as you have come up and down Beacon Street very often, and smoking very badly. Here it is again, belching out black smoke, as it is, in fact, doing most of the time. There is no secret about this. Anybody can go and see it, of course; and many of you have seen it over and over again.

Then, in the immediate neighborhood of this hotel, just over here

by City Hall avenue, is the Niles Building, and that [exhibiting a photograph] is what the Niles Building was doing a good deal of the time last winter, and has been doing some of the time since, but less after these photographs were shown in the legislature last winter. Here it was on another day. This was not very far from the smoke inspector's office, and I felt, and I think I had a right to feel, that the smoke inspector was not a very live man when that sort of thing was going on. There you have it. It is an interesting demonstration of how not to do it.

But there are other people that need looking after. There is Uncle Sam. The Post-office Building has two chimneys. One of them at this particular moment was pouring out a great deal of black smoke, the other a little; and they take turns. Sometimes they work together.

In order to see what the city as a whole showed, Mr. Underwood went up on top of the Hotel Essex; and he got the next view. Now that is very instructive. It shows that most of the city is free from smoke, but that there are certain places that are smoking very badly. There was Houghton & Dutton; and here is the Niles Building, if I am not mistaken. Here is the Post-office; and there was another building further down town, of which I don't know the name. In other words, there were localized emissions of smoke coming out. But there are other cases which are bad. Here is the power-house of the Boston Elevated Railroad, which you have all seen smoking almost constantly night and day, pouring out vast volumes of black smoke. It is on Albany Street. Here it is again, on a day when the smoke does not go off over the harbor, but drops down on the neighborhood. If you can look at that, and say that Boston has no need to wake up on this subject, you have a different opinion from mine.

And then, in order that you may say, "Well, after all, these are only a few localized things," I want to show you what Mr. Underwood got from the top of the Hotel Touraine, looking north-eastward. Here is the big square stack of the Edison Electric Light, which, you know, often pours out vast quantities of smoke. But what is more important is the general appearance of that picture. Can you look at that, and say that Boston is not on the road to a condi-

tion such as you get in Cincinnati and Chicago and Cleveland? I tell you it has gone a long way in that direction; and it is high time that we waked up, and did something about this matter,—high time. Just study that picture as it goes round, and say, if you can, that there is no need of action.

I have shown how easy it is to deal with the thing when it is done in a small way, provided you get intelligent firing; but many of these establishments are not hand-fired, or at least they use so much coal that it becomes desirable to do something else. We have several establishments in the city which are models of good firing; but there is one in particular, namely, the South Terminal Station, which has a power-house on the east side of the station, toward the salt water, not very far outside the station. You probably have noticed a brick building there, where they make the Pintsch gas, and where they furnish the power for lighting the Terminal Station and for heating it and for heating the cars in winter, and so on. They burn there from twenty-five to fifty tons of soft coal a day; and, if you go down and look for their chimney, you won't find it. There isn't any chimney, to begin with. All the chimney you can find after looking around is that big thing in the middle of this picture, which is only thirty feet high; and, as you look at it and watch for the smoke to come out, it does not come. There isn't any. That is the way that thing works, to the best of my knowledge and belief, most of the day. Mr. Underwood, after taking a photograph of it, went and asked them to stir up things and make all the smoke they could, while he went out and took a picture. They did so, and that is what he gets. Mr. Underwood is one of us, gentlemen. He is a member of the Belmont Board of Health. He is a scientific man. He has no interest in this thing except the interest of the public health. These pictures are perfectly straight and honest; and that is all he got.

How do they do it? That is a wonderful result. How do they get it? It is no more wonderful than what they have in many cities where they have abated the smoke nuisance altogether; but it is wonderful for a city which is so far on the road to the smoke nuisance. They do it in this particular case by the use of a mechanical stoker. It is an arrangement which works by steam. It is attached

to the feed, to the coal supply, in such a way that every little while it pushes in some coal, which falls down steps where the coal is afire. But the hottest part of the fire is way over beyond, and the coal that is first put in before it gets there has coked a little bit. Then it is pushed on, and pushed on; and, as it gets hotter and hotter, it is finally thoroughly burned. The smoke from the first part passes over the back part of the fire, is raised to a high temperature, and is burned there. That is one of the well-known "mechanical stokers."

There are other kinds. There is a very ingenious one which is being used in Cleveland and in many other places a good deal, the agent of which sent me a circular the other day, saying that they would guarantee a fuel economy of 10 per cent. Now a fuel economy of 10 per cent. will pay for a mechanical stoker very quickly. This is known as "an under feed." I mention it to this extent, because there are several "under-feed" stokers. This one has the very ingenious thought underneath it of pushing the coal up into the middle of the fire from below, so that the hottest part of the fire and where the most of the combustion is going on is always on top; and whatever smoke is generated down in the bottom of the fire has to go up through the hotter parts of the fire. It is a very ingenious scheme.

There are many ingenious schemes. The American people have the power of invention. They are not going to allow their cities to become smoky holes, like London. It is idle to say that we, who are invading the markets of the world with our commercial enterprise, have not got brains enough and energy enough to overcome the smoke nuisance. We have, and we are going to do it.

Now, gentlemen, speaking purely personally and for myself, I want you to do what you can to help on the passage of this bill in the legislature. We have a general law for the cities and towns of the State, but it is only applicable when accepted by the city councils. Many of them won't accept it; and, even if they did, it is only a local thing. The Greater Boston, with Brookline and Cambridge and Newton and Milton and Somerville and Chelsea, and all the rest, is one great city. If smoke is made in East Cambridge, it will roll over upon Boston, as I saw it doing within a week, so that the

Common, Boston Common, had a lot of smoke on it directly traceable to East Cambridge. Conversely, Boston makes smoke, and pours it over on to Cambridge and Somerville and Brookline. This bill is for the good of the whole community. We believe that there is no hardship in requiring the consumers of soft coal gradually, and after a reasonable length of time, which this bill provides for,— for it is not to go into effect until January 1, and in exceptional cases may be delayed until July 1, 1903,— we say we believe that there is no hardship in requiring the consumers of soft coal either to put in mechanical stokers or devices which shall prevent the emission of smoke or else to have firemen intelligent enough and careful enough and willing enough to do their work to do what they call "one-shovel" firing, putting on one or two shovels at a time instead of half a ton at a time, and then sitting down and smoking a pipe. That is the whole root of the trouble. The thing is perfectly simple.

Having studied the matter thoroughly, I honestly believe that we shall not be inflicting any serious hardship or injustice upon any manufacturer or commercial interest. We want the commercial interests to prosper in this community, but we want also the æsthetic and the domestic and the sanitary interests to be conserved. It lies in your hands and mine, gentlemen, and in the hands of the intelligent citizens of the Greater Boston and their friends in the legislature from all over the State, to say whether this evil shall continue or whether it shall be throttled in its infancy. If we allow the city once to get full of smoky chimneys, the standard of the people will be let down. They will take a hopeless attitude. They will say: "Well, you cannot help this thing. It has come, and it has grown up around us; and it is too late now to do anything." Now, therefore, is the time. I would appeal to you to use all proper and legitimate efforts to impress upon your representatives in the legislature the reasonableness and the need of this reform to-day and in the present session of the legislature. The Committee on Cities has been interested. It has revised the bill in a skilful and good way; and we believe that the bill, when carefully studied, will meet the approval of an intelligent community. We are not ready to have the beautiful buildings of Boston become smutted and smirched and blackened by soot. We

don't like to have our muslin curtains befouled with soot and smoke; and we do like to keep clean with our books and papers, in engineering offices and in law offices and wherever we are. Above all, we want to keep Boston, and the Greater Boston, as a desirable *home* for the people; and we know that, if we begin by making them dirty with smoke and soot, it will be difficult to keep them clean from the sanitary point of view in other directions. This is to a great extent a sanitary question. We will grant that the death-rate of London, where the smoke is abundant, is low. We will grant that many cities which have a smoke nuisance have a lower death-rate than some cities that have no smoke nuisance. But we do know that smoke favors fog, and that general habits of dirt induce specific habits of dirt; and we believe that this is a proper field for boards of health.

Fortunately, we have with us to-day a gentleman who can tell us what they have done in New York. I can tell you from my own personal observation, repeated now many times, that the city of New York is practically smokeless, and that the city of Boston is on the down track in this direction, and moving very rapidly; and, if we don't look out, it will get so far down that it will not be easy to bring it back to its former clean condition. This thing is only five or six years old in any magnitude; and, if we work now, and all together, and for the best interests of the community, I believe that posterity will be grateful to us through all generations. [Applause.]

The CHAIRMAN.— I have now the pleasure of introducing a gentleman from New York who is assistant chief in the Department of Food Inspection and Offensive Trades, and has particular charge of this matter which has been the subject of the paper by Mr. Warren. I take great pleasure in introducing Mr. Russell Raynor, of New York. [Applause.]

Mr. RUSSELL RAYNOR, of New York.— Mr. Chairman and gentlemen, I think that perhaps the best way to show you what we do in New York would be for me to start in with a smoke case at its beginning, and follow it right straight through to the end, describing the way our inspectors look after it. Then I will give you a few

figures, showing you the number of cases that we have had in the past four years, and what has become of them.

In the first place, the citizens of New York are probably the best smoke inspectors that we have. If you let a little bit of a chimney start up and smoke under a man's windows, inside of a day you either have a telephone complaint or a written complaint. Besides the complaints which come in from the citizens, the sanitary inspectors of the department are assigned to small districts for general sanitary work; and, in addition to that, they are required to take cognizance of all discharges of smoke that they may see in their district or even that they may see outside of their district. They report the name and address, together with the character of the business. Then the records are looked up; and, if there is no order in existence against the plant, an order is issued. After the smoke has been seen, an order is issued by the department requiring the owner or the lessee or the tenant or whoever is in responsible charge of the premises to discontinue the discharge of smoke forthwith. Forthwith means that the plant is reinspected the day after the issuance of the order.

After the order is issued, a duplicate copy of the order is referred to the original inspector who recommended it. He then reinspects the premises; and, if he finds after watching the chimney for half or three-quarters of an hour that there is no smoke, then he is justified in returning that the order has been complied with. But we don't stop with one inspection. We take another inspector, and send him there the next day or within a few days at a different time during the day, so that, if the first man happened to catch the chimney during a light period, the other man might have a little better luck. He watches it for half or three-quarters of an hour; and, if he gets no smoke, why, then he indorses it "Order complied with." Then it goes to a third man, and he goes through the same routine. If, at the end of three inspections, we find that all three inspectors report that there is no smoke, we feel justified in presuming that the nuisance has been abated or, at any rate, it is so reduced that there is no further cause for complaint.

If, on the other hand, the inspector finds that smoke is still being discharged, he indorses on the report that smoke is discharged and

the nuisance is not abated. That paper is immediately referred to the corporation counsel. The corporation counsel has a printed form, which is mailed to the man in whose name the original order has been issued, notifying him that his attention has previously been called to a violation of the sanitary code, and that, if the order is not complied with within two days or before the next inspection by the inspector, or if he has not begun work to comply with the order before the next visit of the inspector, the matter will be presented to the criminal courts. Then, after the two days have expired, the order is sent back to the inspector. He makes another careful inspection. If he finds smoke, he then goes in and sees the engineer or the superintendent or the owner or the highest man in authority that he can reach, and has a little conversation with him, and gets him to admit that he is the responsible man. Then he takes a look down in the fire-room, and sees what sort of coal they are using, whether they have any smoke consumers or any smoke preventers or mechanical stokers or whether they are using any particular care,—in fact, gets a general idea of the situation. Then he reports back that he has found smoke, and he also makes a little report of these additional facts. The paper then goes to the corporation counsel again; and, unless there are some very great extenuating circumstances in the case, he then orders the arrest.

It has been customary in the past for all arrests to be made by two or three of the older inspectors, men that have been with the department the longest, and consequently have had more experience in doing court work. Up to within about six months ago I practically made all the arrests that were made. The way I would usually do was this: I would take a man with me armed with a good-sized camera (I have some pictures here which show a little different condition), and put him up on some convenient roof somewhere, let him take pictures of the chimney for five or ten minutes, showing the discharge of smoke. Meantime I would go down in the office, have a little talk with the proprietor. I sometimes would have a sanitary policeman with me. In other cases, where the violation was less flagrant, I would procure a warrant from the police magistrate.

After we had gotten everything together and I had made up my

mind that my photographer had some pictures that would prove to be useful as evidence, the sanitary policeman would then make his arrest and take the proprietor to the police court. He there usually would be held under bail for examination. Very frequently, after a man has been arrested, he gets much busier than he was before he was arrested; and in about half of the cases they abated the nuisance between the time they were arrested and the time the case came up for the hearing. The rest of them had to go to trial, but out of the total number of cases that we have had there were only some forty odd that ever got as far as a trial.

Since the middle of 1898 there have been 446 orders issued altogether on smoke nuisances. And, by the way, we do not call it a smoke nuisance in New York, we do not attempt to prove it a nuisance: we simply say that the discharge of smoke is a violation of the law, under Section 134 of the Sanitary Code. We had 446 cases altogether; and 190 of those were caused by the careless burning of sawdust, shavings, and wood refuse, and things of that sort, in manufacturing plants, furniture factories, and piano factories and places of that sort,— absolute carelessness usually accounts for these cases,— and the other 256 were from soft coal. Some of them were in rolling mills, others in power-houses, breweries, and the rest in general manufacturing plants. In those 446 cases it was only necessary to make arrests in 97 cases, and of those 97 cases 43 were discharged in the police court because they had abated the nuisance between the time that they were arrested and the time that they came up for examination. Of the 54 that went to trial, 19 abated the nuisance between the examination and the time of their trial; and in those cases, after we had succeeded in obtaining a conviction, the corporation counsel recommended that the court suspend the sentence. So that of the total number of cases brought there were only 35 in which there were fines imposed, and of those cases 24 were burning coal and 11 were burning sawdust. We collected fines amounting to $975 for coal and $575 for sawdust. Almost as much of our trouble has been caused by sawdust as coal.

When an order has been issued against a plant, it has been very customary for the owner, or the engineer, or some responsible man, to call at the office, and say: "Well, now, gentlemen, we will be very

glad to stop this smoke; but we don't know how to do it. We wish you to recommend a smoke consumer." We invariably have refused to recommend anything. We have said, "We are not here to stop nuisances ourselves: we are simply here to tell you that there is a nuisance, and you must stop it." A man has sometimes gone away and tried, and at other times he has teased a bit for the information. The greatest extent to which we have gone in giving advice has been to mention half a dozen other places in the city that are carrying on the same line of business that he is, and say: "Go and see So-and-so. He had a smoke nuisance, and he has stopped it. And this other man has stopped it, and So-and-so has stopped it." We have tried to pick out three or four different devices, so that we could not have the name of recommending anything in particular. Sometimes the owners have adopted some of the devices that they have seen, in other cases they have put on something entirely different, and still in other cases, as Professor Sedgwick has pointed out, they simply have abated the nuisance by careful firing.

To show that all these statements that have been made about New York City, or about the cleanliness of the atmosphere of New York City, are close to the truth, before I came on here two weeks ago to speak on this smoke matter to the City Committee of the legislature, I had a few photographs taken. Without telling the photographer what my object was, I said, "I want you to go around the city and take pictures from tall buildings and other points of vantage, that will show the condition of the city as it exists to-day." He started out on Friday and Saturday morning, April 3 and 4, and took these pictures from different parts of the city. I doubt very much if in any of them you can find anything that looks like smoke at all.

This first picture was taken from the top of the tower of the new East River bridge, which is going across the East River from New York to Williamsburg, somewhere near the foot of Grand Street. It is looking north-west, right over a crowded district of tenement houses and a large number of small factories, small wood-working factories and factories with one little boiler, where they are burning soft coal and refuse and everything else all mixed up. That was taken some time through the morning; and, as far as I can see, there is no sign of smoke in the picture at all. This group of three were taken from

the top of the *World* building, and one is looking over toward Brooklyn, one is looking down town, and one is looking out over City Hall and over toward the Hudson River and Jersey; and there is no smoke in them. The next two pictures are all in the neighborhood of the gas-works and some of the slaughter-houses on the west side of the city, where they burn bituminous coal almost exclusively for power purposes. This next picture is one of the power-houses of the New York Edison Company. It is not complete yet, but the two right-hand stacks have boilers under them which are in operation. They are burning nothing but soft coal in that plant, and have the furnaces fitted with Rooney stokers. This is a picture of the brewery district, 92d Street in the neighborhood of Second and Third Avenue. There are somewhere in the neighborhood of six or eight breweries in this group. Every one of them uses soft coal. At times they have made quite a little discharge of smoke, and I think the engineers of at least three of them have been arrested at different times. At present there is no smoke there. This next picture is a general picture of the east side of the city in the neighborhood of 23d Street to 42d Street. It takes in two power plants, those two large electric light power plants, and a number of small woodworking plants. That was taken from a ferry-boat, and is a little bit hazy, owing to the motion of the vessel. It is not very distinct. And this last picture is one that approaches nearer to your — I think you call it the West End power-house. . . .

Professor Sedgwick.— Elevated Railroad.

Mr. Raynor.— It is the power-house that furnishes the power for the Metropolitan Traction Company. That was taken Saturday at half-past eight or nine o'clock in the morning, right at the busiest time in the day, when everybody was going down town to business. They have in there about 100 boilers. Each one of them is of about 850 horse-power. There never has been a pound of anything but soft coal in the place, so far as I know. The boilers are all fitted with Rooney stokers. While sometimes you will get a little more smoke than you ought to have from the chimney, this picture shows the chimney as it is under ordinary circumstances, perhaps

twenty-nine days out of thirty. These pictures are a very fair exhibition of what New York is to-day. You can go round Manhattan Island on a boat, or cross the North or East River on a ferry-boat, and take in the water front of the borough of Manhattan, the borough of Brooklyn, the borough of Queens, and part of the borough of Bronx, and I doubt very much if in the whole trip you would see over two or three chimneys, at the very outside, smoking; and it would be very safe to say that those three chimneys were under observation, or had an order pending against them, or that the proprietors were awaiting trial. According to my mind, the suppression of smoke can be very readily accomplished if you put it where it belongs, in the health department. If your chief inspector has half a dozen or a dozen good men to assist him, he can very soon pick out the offenders, and inside of six months there will not be conditions [applause] such as confront us all in a short walk through this old New England city, which, as I recollect it, as I saw it ten years ago, was as little smoke and soot ridden as New York is to-day.

The CHAIRMAN.— Is there any question to be asked or further remarks to be made? If not, our time being limited, we must proceed to the next article on the programme, the report of the Committee on Diphtheria Bacilli in Well Persons, by Dr. Chapin, of Providence.

Dr. CHAPIN, of Providence.— Mr. President, the report of the committee is divided into two parts. The first part deals with the question of what should be done with well persons who have diphtheria bacilli present in their throats or noses. The second part of the report deals more with the technical aspects of the question, and presents a tabulation of the results which were obtained from the investigations of our co-workers and the deductions made from them.

REPORT ON DIPHTHERIA BACILLI IN WELL PERSONS.

BY A COMMITTEE OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH.

FIRST PART.

Executive.

Your committee, when first appointed, July, 1900, attempted by a circular letter to learn what was being done in different American cities with well persons infected with diphtheria bacilli, and what were the views of the health officers as to the proper methods of controlling such cases. A summary of the replies received was presented at the Association meeting held Jan. 24, 1901. The replies showed that in only two cities, Baltimore and Providence, was a systematic attempt made to isolate well persons carrying diphtheria bacilli, that this rule applied chiefly to members of families in which clinical diphtheria existed, and that in Baltimore it applied chiefly to the school children in such families.

It was found that few data were available concerning the occurrence of diphtheria bacilli in well persons; and it was deemed advisable to institute, on a co-operative basis, an extended series of observations which would give us more accurate knowledge on this point. A circular letter asking for such co-operation was sent to about twenty bacteriologists. A number of favorable replies were received, and the following-named actually entered into the work: —

Boston, Mass.	Dr. H. W. Hill and Mr. B. R. Rickards, with Dr. A. A. Taft and Drs. D. N. Blakely, W. S. Boardman, Paul Carson, John Duff, Theo. C. Erb, C. O. Kepler, C. Morton Smith, John T. Sullivan, and A. A. Wheeler.
Brookline, Mass.	Dr. F. P. Denny.
Lowell, Mass.	Dr. T. B. Smith.
Minnesota	Drs. F. F. Wesbrook, L. B. Wilson, O. Mc-Daniel and E. H. Bechman.
Newton, Mass.	Dr. Arthur Hudson.
New York City	Dr. W. H. Park, with Dr. A. C. Williams.

Ontario, Canada	Dr. J. A. Amyot.
Providence, R. I.	Dr. C. V. Chapin and Prof. F. P. Gorham.
Springfield, Mass.	Dr. H. C. Emerson.
Waltham, Mass.	Dr. C. A. Willis, with Drs. W. E. Fernald, I. H. Ladd, and George L. Wallace.
Washington, D.C.	Dr. W. C. Woodward and Dr. John E. Walsh.
Willard State Hospital, N.Y.,	Dr. W. A. Macy and Dr. Erving Holley.

The Association will doubtless join the committee in expressing their thanks to those who, though some of them not members of the Association, so willingly assisted us in our undertaking.

The results of these investigations are given in detail in the second part of this report.

Prevalence of Diphtheria Bacilli in Well Persons.

Of the questions before the committee, the first which they have attempted to answer is, how frequently diphtheria bacilli are found in well persons.

All observers are not in accord as to the morphological appearances which are to be considered as characteristic of this organism. Some agree with Wesbrook in the belief that diphtheria bacilli are found to present all the forms named by him. Others admit the validity of only a portion of these types. Some do not believe that the so-called pseudo-diphtheria bacillus, the short solid-staining type, is a true diphtheria bacillus, while others are entirely satisfied that it should be classed with *B. diphtheriæ.*

In order to answer, from our collected data, the question of the degree of prevalence of diphtheria bacilli in well persons, we may allow the different observers to state for themselves how many of their cultures they would, in the vernacular of the laboratory, have reported as "positive." Not all responded to this request. (See Tables I and II.)

In Boston, about 1 per cent. were considered positive; in Brookline, 2.3 per cent.; in Lowell, 1.2 per cent.; in Springfield, 1.6 per cent.; in Providence, 9 per cent. (see Footnote, Table I); and, in the District of Columbia, 22 per cent. These figures are chiefly interesting as indicating the divergent views of bacteriologists, and as explaining the widely different results hitherto obtained by dif-

ferent observers; although it is probable that the actual prevalence itself varies in different places to some extent.

Another way of stating the results of this work was for the committee to assume that certain forms would, by the majority of bacteriologists, be considered as diphtheria bacilli. The forms which we think would usually pass as diphtheria bacilli are Wesbrook's A, C and D. On this basis we found that 2.89 per cent. of the total persons examined (nose and throat) were infected with diphtheria bacilli, or, leaving out the returns from Minnesota, 1.39 per cent. It may be observed that the number reported positive did not correspond in all cases with the number of persons showing A, C, D (Tables I and II).

The bacteriological examinations made by members of the committee and those who worked with them, except certain cases classified as "special", not included in the main tables, and many of the Minnesota results, were confined to persons who had not, so far as known, been recently exposed to diphtheria. When examination is made of the throats of those who have recently been in more or less direct contact with diphtheria, infection is found more frequently. No observations on this point were undertaken by the committee; but, from the investigations of Chapin, Denny, Kober and Park, it is probable that from 8 to 50 per cent. of the well persons in families where there is diphtheria are infected with the bacilli.

In institutions, particularly institutions for children, where diphtheria has prevailed, the infection appears often to become more general; and a considerable number of the children will often be found to have diphtheria bacilli in their throats or noses. Occasionally cases of true diphtheria develop, or perhaps marked outbreaks occur. Wesbrook reports such a condition in a school at Owatonna, Minn., and in Bethany Home, Minneapolis; a similar experience was met with in an orphan asylum in Providence. It is to be noted that the types on which this wide distribution was determined included many others besides A, C and D, and that the diagnosis of a large part of the infection observed was based on the presence of the solid forms.

The committee feels justified in the inference that, in urban communities, at least 1 to 2 per cent. of well persons among the general

public are infected with the types A, C and D, and that where well persons are exposed to diphtheria, as in families, schools, or institutions where cases exist, the number infected is much larger, and may range from 8 to 50 per cent.

The estimates just given in the last paragraph refer to the prevalence of the typical granular types of diphtheria bacilli. If the solid and barred types be also forms of this organism, it is very much more widely distributed than is above assumed. The question as to what should properly be considered diphtheria bacilli is discussed at length in the second portion of the report.

Virulence of the Diphtheria Bacillus as Found in Well Persons.

There is no doubt that even the most typical forms of the diphtheria bacillus vary greatly in virulence and power to produce toxins. Oftentimes cultures will produce no constitutional symptoms when injected into guinea pigs; and, as is well known, persons with morphologically typical bacilli in their throats may remain free from all clinical symptoms, and may mingle freely with others without spreading the disease.

It would be of decided advantage to know whether the bacilli found in well persons are usually virulent or not. There are two ways of determining this.

A. By the Guinea Pig Test.

The probable value of this test and the method of its application will be discussed in the second part of the report. Suffice it to say here that a sufficient number of tests have not been reported to the committee on which to base any very general conclusions. However, those that have been reported resulted as follows (Table XII): forty-seven pure cultures of Wesbrook's types A, C and D, obtained from well persons were inoculated into guinea pigs. Of these, 17 per cent. were virulent. Of the types other than A, C and D, thirty-nine inoculations were made; and 7.5 per cent. proved to be virulent. All these latter positive results were from Providence. Gorham was the only observer to report virulent pure cultures of the solid-staining types C^2 or D^2. Wesbrook also at times has found

these types virulent, but made no virulence tests in this particular investigation.

B. By Clinical Evidence.

We may perhaps learn from clinical experience whether well persons with bacilli in their noses or throats do really give the disease to others. A number of our correspondents have reported instances in which it seems very certain that this was the case. (Preliminary Report: Journal Massachusetts Association Boards of Health, January, 1901.) On the other hand, it may be argued that the bacilli carried by well persons are frequently, perhaps most frequently, non-virulent for two reasons: first, the persons themselves are not sick; and, second, diphtheria is not so common as it would be, were virulent bacilli constantly distributed by the considerable number of infected well persons. If immunity, natural or acquired, be as wide-spread as stated by some authorities, these reasons would of course lose their weight.

We seem to be justified in concluding from an examination of the experimental and clinical evidence at hand that only a small percentage of the morphologically typical diphtheria bacilli found in well persons not recently exposed to the disease are virulent; but the number of infected individuals well enough to mingle freely with others is so great that, even if only a small proportion of them be likely to transmit the disease, we have in them a very important factor in the spread of diphtheria.

Danger of Infection from Healthy Persons.

The danger from a healthy person depends on the age, the habits, the surroundings, the occupation, and the intelligence of the infected person.

A child who is constantly putting its hands and everything else into its mouth, and who plays with susceptible children of similar habits, is more likely to spread the disease than an adult. Infected individuals of cleanly habits are less likely to disseminate bacilli than the uncleanly.

The danger from an infected person depends also on his surroundings, whether he comes in contact with other individuals in such

a way that he is likely to infect them. Thus in a crowded tenement the opportunity for spreading the infection is much greater than it is in a private house. In institutions, infected persons are much more likely to spread the disease than elsewhere.

The occupation of the individual is very important. Thus persons who are engaged in handling articles of food (like milkmen) and those whose work brings them in close contact with small children (like nurses) are more likely to spread the disease than day laborers or clerks.

The intelligence of a person should be considered. An intelligent person can easily be taught to take a few simple precautions which will greatly reduce the risk of infecting others, without imposing any serious restrictions upon him. The manner in which the infection is spread can be explained to him. He can be taught to sterilize everything which comes in contact with the secretions of his mouth or nose, and to avoid sneezing, coughing, or even talking toward and in close proximity with another person. A few simple precautions of this sort, carried out by an intelligent person, will greatly lessen the danger of infection.

The danger from the rooms occupied by a healthy infected person is very slight. It is probably no greater than that of an electric car or any other much frequented public place into which some infected persons are undoubtedly coming very often.

Conclusions.

In our conclusions we recognize that there are two classes of persons carrying diphtheria bacilli to be considered.

A.

There are scattered among the general public a considerable number of persons, not recently and directly exposed to the disease of diphtheria, who have typical diphtheria bacilli in their throats. Our observations show the average, for all places reporting, to be nearly as high as 3 per cent., or in the east 1.39 per cent. This would mean in Boston, if the smaller figure be used, about 8,000 such cases. The mere statement of this fact shows how entirely futile it is to

attempt to seek out and isolate the whole of this number. If this cannot be done, it is useless and unjust to isolate the small number that it may be possible to discover. We are therefore led to adopt the following as our first conclusion: —

Conclusion I. It is Impracticable to isolate Well Persons Infected with Diphtheria Bacilli, if such Persons have not, so far as known, been recently exposed to the Disease.

If it happens that such cases come to the knowledge of the health officer, it would, however, be wise to give instructions in regard to caring for the secretions thus placing a part of the responsibility of the case upon the infected person himself.

B.

We may assume, and with some show of probability, that the bacilli in well persons recently exposed to diphtheria, are more likely to be virulent than are others, and we might attempt to isolate all members of families where diphtheria exists, so long as the bacilli are found in the throat or nose; but there are difficulties in the way. Such a procedure would, in many cases, lengthen the period of the family isolation, and prove most exasperating to the family and to the medical attendant. Wage-earners, business and professional men, would be kept at home and away from important work. It is difficult to maintain the isolation of the patient during a long convalescence; but it is far more difficult to isolate a person who has not been sick at all. It is very difficult to persuade a man that he should remain at home because he has diphtheria bacilli in his throat, when one is obliged, in answer to his inquiry, to admit that there are hundreds of others going freely about, although infected like himself. It is usually useless to try to tell him that the conditions are different in his case, that his bacilli are derived from a recent case, and have been proved virulent. He will not accept the reasoning, and very likely his medical adviser will not accept it.

If, instead of a single throat culture, as is required in most places, two successive negatives from nose and throat are made necessary for release, the difficulties will be still further increased; and, if two

negatives are not required, many infected will escape, and the object of the whole procedure will be defeated.*

Since the number of persons among the general public who are infected with diphtheria bacilli and who pass unrecognized and unrestrained may at any one time be greater than the number of infected persons in diphtheria families, it does not seem to be expedient to place restrictions upon the latter except when it can be done without causing much friction or hardship, or unless the danger in any particular instance can be shown to be very considerable.

We are therefore led to our second conclusion : —

CONCLUSION II. IT IS NOT ADVISABLE AS A MATTER OF ROUTINE TO ISOLATE FROM THE PUBLIC ALL THE WELL PERSONS IN INFECTED FAMILIES, SCHOOLS, AND INSTITUTIONS.

It is advisable to keep the children in infected families away from day-school, Sunday-school, and all public places, and that they should remain on their own premises, if possible.

Wage-earners may usually be allowed to continue their work; but teachers, nurses, and others who are brought in close contact with children should not be allowed to do so. Milkmen should not be allowed to continue their business.

When it is proposed to remove a well person from an infected family, it is not advisable to make the removal if diphtheria bacilli are present.

In schools and institutions it is usually advisable, if the infection is not too wide-spread, to separate from the others all infected persons, sick or well.

When diphtheria appears in a community which has for some time been free from it, it is advisable to isolate all persons who have been brought in contact with the patient until it shall have been shown that they are free from diphtheria bacilli.

While believing that it is not possible in the majority of cases to

*This method of keeping at home those members of families in which diphtheria exists who are infected with diphtheria bacilli was carried out very faithfully in Providence for a period of five years, but has been abandoned because it met with very decided opposition from both the laity and the medical profession ; it should be noted that in Providence only one throat negative was required for release.

isolate well persons infected with diphtheria bacilli, we believe that the attempt should be made to educate the public to care for their persons and their secretions, so as to avoid, as much as possible, the danger of infecting themselves or others. We would again call attention to the suggestions made at a former meeting for teaching cleanliness to school-children, and similar advice might be profitably given to the members of families where diphtheria exists.

In thus putting before the Association the results of both practical and experimental work concerning diphtheria bacilli in well persons, we do not wish to be understood as minimizing in any way the possible danger of bacilli-carriers to their environment. We have simply recommended what appears to be the most expedient course to pursue after considering the various conflicting interests of the public and the infected individual. The responsibility is largely shifted to the latter, and in the case of intelligent persons the individual responsibility in disseminating disease should be clearly placed before the infected person.

The various local health authorities, in accepting these suggestions, must necessarily exercise increased care, watchfulness and discrimination, and should be prepared at any time whenever special circumstances warrant it to isolate any and all persons who are discovered with presumably virulent diphtheria bacilli.

The technical portion of the report, including the tabular presentation of the results of the observations of our co-workers, has been prepared by the bacteriologists of the committee. Dr. Denny has that part of the report, and I will ask him to read it.

The Chairman.— While so many are present, I want to call attention to the fact that it has been moved and seconded that a vote of thanks of this Association be tendered for the excellent paper by Mr. Warren, of Boston, and also for the excellent detailed account of the work in New York City upon the smoke nuisance by Mr. Raynor.

The motion was adopted.

The Chairman.— Dr. Denny will read the remaining portion of the report.

Dr. Denny.— Mr. President and gentlemen, I have here the second part of the report, which has been prepared by the bacteriologists of the committee. Dr. Theobald Smith has written an introduction to this part of the report, which I will read.

SECOND PART.

Bacteriological.

The fact that diphtheria bacilli may, and frequently do, persist in the throat and nose of patients some time after recovery, and that even persons not clinically diseased may, in certain instances and for a variable period of time, harbor virulent bacilli, is entirely in harmony with our knowledge concerning the relation of disease germs to the individuals liable to their attack.

Before discussing its significance more in detail, we may state that the causal relation of the Klebs-Loeffler bacillus to what is clinically known as diphtheria is as firmly established as that of any of our well-known pathogenic bacteria to their respective diseases. This is based on the following facts : —

1. The Klebs-Loeffler bacillus is the only species regularly present in diphtheria. It is most abundant at the height of the disease, and disappears soon after convalescence.

2. This bacillus produces a poisonous substance, or toxin, which after injection into animals produces inflammatory and hæmorrhagic œdemas, necrosis, or sloughing of tissues, and paralysis.

3. The antitoxin produced by the injection of the toxin is specifically preventive and curative.

The popular conception that disease germs enter, permeate, and then pass out of the body like an orderly army without stragglers, is not confirmed by observation or experiment. There are two opposing forces in every infectious disease, and the variation in the resistance of the individual and in the virulence of the bacteria make the resultant disease a very variable quantity. The same is true of the final exit and destruction of bacteria after recovery, and leads to the inference, proved in a variety of diseases, that persons, to all appearances well, may carry disease germs. There is no basis for

the belief that such bacteria are necessarily non-virulent. Their harmlessness to the carrier may simply be an expression of his immunity, either inherited, or acquired at some earlier period through disease. Laboratory tests show clearly that such microbes, when identified as belonging to one or the other species of pathogenic bacteria, are, as a rule, of the usual virulence.

These organisms are frequently carried in such a way as to be easily shed, and hence to be a source of danger to others. Thus in chronic pulmonary tuberculosis a person may for years expectorate immense numbers of tubercle bacilli. In individuals who have recovered from typhoid fever the fæces, and particularly the urine, may contain typhoid bacilli for a time. Mild cases of typhoid, not recognized, may lead to epidemics. In Asiatic cholera the spirilla have been found in the stools of well persons living within the infected area. It is probable that in influenza the microbe may vegetate on the mucous membrane for some time after recovery. Lastly, it has been known for over twenty years that the diplococcus of croupous pneumonia flourishes on the mucous membrane of the throat of certain persons.

If we consider for a moment this list of pathogenic bacteria likely to survive the disease they produce, we find that they peculiarly represent those maladies having a starting-point, or producing lesions, in the mucous membranes. The diphtheria bacillus vegetates chiefly on the surface, sending its toxin inward, and this localization of the bacilli gives them a special opportunity to escape destruction by the body and to vegetate in immune individuals for a time. In fact, we need not be surprised if in the future more persons shall be found carrying these bacilli than the present figures indicate.

As there is no sharp line to be drawn between the healthy and the diseased state, one shading imperceptibly into the other, so there is no sharp line to be drawn, for many infections at least, between the time when the micro-organisms are still in the body and when they have all been destroyed or eliminated. It follows logically, as is shown by the work of certain members of this committee, that well persons may be at times the source of infectious diseases.

In the capacity of bacteriologists it becomes our duty to emphasize the facts, that well persons may be the source of virulent disease

germs, and that public-health authorities cannot concentrate their attention on health and disease as such, but must take cognizance first and foremost of the whereabouts of disease germs ; and in so doing they practically admit that the carrier of such germs, even if well, may be fitly compared to the spark which may or may not start a conflagration.

The measures to be carried out in dealing with individual carriers, when discovered, must be left for the health officers to devise. Such measures will naturally depend on the relative dangerousness of the disease involved, on the relative ease with which the bacteria may be disseminated, and, in fact, upon a number of conditions which do not come within the scope of the bacteriologist, but which must be settled on purely practical grounds.

Technical Results.

The following is a report of the results of the investigations which have been carried out by the committee, together with a simple statement of our present knowledge of the diphtheria bacilli found in healthy persons.

The chief objects of the investigations have been to determine: first, the frequency of the different forms of diphtheria-like bacilli in healthy persons, and, second, the virulence of the different forms.

A number of laboratory workers were asked to examine separate cultures from the nose and throat of healthy persons, to record, according to Wesbrook's classification, all the diphtheria-like bacilli which were found, to state whether or not they would report the cultures containing such forms as positive or negative if the cultures were taken for release, and finally to isolate these forms in pure culture and to test their virulence on guinea pigs.

The number of persons which have been examined and so recorded that they could be classified on the basis intended, is 3,953. They were as follows : —

1. In the Minnesota State Board of Health Laboratory in Minneapolis, 1,154 children and adults in institutions.

2. In the Boston Board of Health Laboratory, 892 adults in prison and pauper institutions.

3. In the Providence Board of Health Laboratory, 541 school children, 376 tramps, 10 small-pox patients. Total, 927.

4. In the Lowell Board of Health Laboratory, 250 cotton-mill hands.

5. In Washington, 205 children and adults in a hospital, and 16 health department officials. Total, 221.

6. In Springfield, 64 school children, 121 male prisoners in jail. Total, 185.

7. In the Brookline Board of Health Laboratory, 129 school children.

8. In the Willard State Hospital for the Insane, 82 inmates.

9. In the Newton Board of Health Laboratory, 63 women students at Wellesley College.

10. In Ontario, 50 patients and attendants in a general hospital.

The virulence of the bacilli in 86 cultures was tested.

In addition to the above, cultures from 1,536 persons were taken in Boston, Brookline, New York and Waltham; but from the incompleteness of their records they could not be classified with the others, and are therefore grouped together under the head of "special cases." (Footnote, Table II.)

The committee had hoped to have larger and more complete returns, and especially a larger number of examinations of persons living outside of institutions. Insufficient time and the inability to get permission to make cultures were the causes of this deficiency.

The work of tabulating the returns to show the relative frequency with which the different types were found in different places and in different classes of cases was very great, and was done by the secretary of the committee, Dr. Hibbert Winslow Hill. The tables in their final form were made largely by Dr. F. F. Wesbrook, who gave much time to this work.

The results of the work will be found summarized in the tables. In order to make them clear, a few words in explanation of Wesbrook's classification of types of *B. diphtheriæ* will be necessary.

Wesbrook's Classification.— Wesbrook divides all the forms of diphtheria bacilli into three groups, according to their staining reactions. Those with deeply-staining granules he calls "*granular forms*," those with transverse bands "*barred forms*," and those stain-

ing evenly "*solid forms.*" He further divides each of the groups into seven types according to shape and size. The types are designated by the letters A to G. Each individual type of the granular group is designated by a simple letter, A, B, C, etc.; the barred forms are called A^1, B^1, C^1, etc.; the solid forms are A^2, B^2, C^2, etc. The types are progressively smaller from A to G in each group.

The different types have been very well represented in plates which were published with Wesbrook's original article.* Through the courtesy of Dr. Wesbrook all the workers were furnished with these plates, so that they might be kept before them while making the examinations. In every culture showing diphtheria-like bacilli the forms present were recorded according to Wesbrook's types on charts which had been arranged by Dr. Wesbrook. We have found this classification to be a very rational one and very helpful in the work. It has made possible a comparison of results which could not have been accomplished in any other way. The difficulty in comparing the results hitherto obtained by different investigators has been that they have not classed as diphtheria bacilli the same types of bacilli. By the method of recording the types present, irrespective of personal views as to the propriety of classing the forms as true diphtheria bacilli, the question of what forms to consider as *B. diphtheriæ* is left to those who may make use of the results. The personal equation may thus be eliminated to a great extent.

This method has also given an opportunity to compare the relative frequency of the different forms of bacilli in different localities. The differences in some instances have been striking. The most marked are found between the results obtained in Minnesota and those in the laboratories in the east. While almost all the forms were more prevalent in Minnesota, the contrast is especially marked in the granular forms A, C and D, which are nine to ten times as frequent there as they are in the east.

In considering such differences, allowance must be made for three variables: —

1. The *personal equation* of the observer, under which must be included *technique* of preparation, and *classification*.

* Transactions of the Association of American Physicians, 1900. Also see Minnesota State Board of Health Report, 1899–1900.

2. The individuals from whom the specimens were obtained; whether they had been recently exposed to diphtheria or not; whether they were massed in such a way as to facilitate exchange of nose and throat contents.

3 Actual differences in locality, with the variables in conditions incident to this alone.

In the Minnesota examinations, cultures were taken almost altogether from children in *institutions* in which diphtheria had existed from one to eighteen months previously. This was unavoidable at the time when the investigations were asked for. It seems worthy of remark that in 316 *day-school children* (Park Rapids), from whom cultures were taken at the beginning of school in September, in a town where diphtheria had existed for eighteen months (this constituting the reason for the examination), the percentage of infection with types C, D and A, was higher than that found in the east, and higher than in Brookline, where the 129 examinations listed were made under somewhat parallel conditions. It was, however, lower than that found in the other Minnesota examinations, except in a wholly diphtheria-free institution (Catholic Orphan Asylum) where the per cent. affected approximated that found in Boston. This seems to bear directly on infection in general, indicating that infection is much more apt to be widespread amongst children in institutions than in day-school children.

As a further illustration of this variation of types in different localities, the results of the examinations of throat cultures by the New York City Board of Health (see Table II, etc.) show even a higher percentage of infection with the more generally recognized types of *B. diphtheriæ* (C, D and A) than Minnesota. There had been more or less exposure in this case also. Further examples are afforded by three observations along somewhat different lines. (1) Gorham found that the types present in Providence in clinical diphtheria ran very considerably smaller than those in Boston (Hill) when actual comparison was made under similar conditions. (2) Wilson of Minnesota found branching forms of *B. diphtheriæ* in abundance in Boston, although they have been seen only three times in Minnesota. (3) Amyot of Ontario states that the types vary with the locality to some extent, since, in studying clinical cases bacteriologically, he

was able to distinguish between two specific localities by the types present.

The results in Minnesota were so at variance with those obtained here that it seemed best to arrange them separately in the tables, particularly as this report was intended primarily for the use of Massachusetts boards of health.*

Frequency of the Occurrence of Wesbrook's Types of Bacilli in Healthy Persons, and a Consideration of the Evidence for their Relation to Diphtheria Bacilli.

Granular Forms.— A, C and D are the forms most commonly present in clinical diphtheria,† and would be classed as diphtheria bacilli by all bacteriologists. One or more of these three forms were present in the nose in .93 per cent. of persons examined in the east, or, including Minnesota, in 2.07 per cent. In the throat they were present in .61 per cent., or 1.46 per cent. with Minnesota. Of all *persons* examined in the east, 1.39 per cent. had these forms present in either throat or nose or both, or 2.89 per cent., including Minnesota. The other granular forms, B, E, F and G, were seldom found in the east. Their relation to diphtheria bacilli is not settled. (Tables I and II.)

Barred Forms.— These are said to be the only forms present in some clinical cases; but this condition must be rare, since some of the committee have never met such a case. They are said to be frequently present in the eye, where they are called the xerosis bacillus. If present in the eye, they can very easily pass through the lachrymal duct to the nose.

Solid Forms.— The bacilli of this group have protoplasm, which stains uniformly, and shows neither granules nor bars. In group A^2, B^2 and C^2 the rods occur singly; while D^2, E^2, F^2 and G^2 appear to be in pairs, often resembling two triangular or cone-shaped bodies

* That the basis of opinion afforded by presence of types in actual practice in Minnesota is not different from that in other localities, is shown by the fact that the average duration of the quarantine period determined by the absence of diphtheria bacilli in two consecutive negative examinations is not greater in Minnesota than that in other localities.

† See also statistics of occurrence of A, C, D in clinical cases, Table XIII; also, Minnesota State Board of Health Report, 1899–1900.

with their bases together. These forms are found very frequently in the nose, as will be seen by an examination of the tables. For example, D^2 was present in the nose in 16.7 per cent. of persons in the east, and 21.8 per cent., including Minnesota.

The relation of these solid types to diphtheria bacilli is still unsettled. They are sometimes met with as variants in pure cultures of diphtheria bacilli. Wesbrook and Gorham claim to have found them present alone in cases of clinical diphtheria. Both of these observers several times isolated solid forms in pure cultures from healthy persons, and proved them virulent to guinea pigs. Such a condition, however, must be very rare, as no other members of the committee have ever found these forms present alone in clinical diphtheria; and, when isolated by them from healthy persons, they have always proved to be non-virulent. Certain of the solid forms have characteristics which have been considered sufficient to differentiate them from *B. diphtheriæ*. Thus, while the typical diphtheria bacillus has a very marked power of producing acid in dextrose bouillon, this property is entirely, or, at least, very often, absent in the most abundant solid forms, certainly those of the D^2 type. For this reason the solid forms are considered by many authorities not to be diphtheria bacilli at all, and are classed as pseudo-diphtheria bacilli or Hoffman's bacillus.

Others consider that these differences are not sufficient to separate them from true diphtheria bacilli. Thus Gorham believes that the changes in morphology are brought about by the action of the body fluids of an immune individual. Both he and Wesbrook find a gradual change from the granular to the solid forms during convalescence from the disease.

What Types should be regarded as Diphtheria Bacilli? — The committee believes that the question of the relation of these types to clinical diphtheria requires more investigation. The following statements, however, seem justified from the available evidence.

The large granular types are the ones most commonly present in cases of clinical diphtheria. They are found in about 1 to 2 per cent. of well persons in this vicinity. The solid forms are very seldom present alone in cases of diphtheria, while they were found in about 20 to 25 per cent. of all healthy persons. It is evident,

therefore, that the granular types are the most important ones in the causation of diphtheria.

Whatever the relation of the solid types to diphtheria, whether they be true diphtheria bacilli or not, it is very obvious that they can be of little diagnostic value, being present as they are in so large a percentage of all healthy persons. Any attempt to base isolation on the presence of such types would be an injustice. Certainly, no restrictions whatever should be put upon a healthy person unless there are present in his nose or throat the forms of bacilli morphologically identical with those commonly seen in cases of diphtheria. In healthy persons, therefore, usually only the granular types, A, C and D should be recognized as diphtheria bacilli. We believe that the persons in whom these three forms are present represent almost all the individuals who are capable of infecting others.

It seems probable, in view of the results obtained by such reliable observers as Wesbrook and Gorham, that sometimes the solid forms, even when present alone, are true diphtheria bacilli; but we believe that this is so seldom the case that the number of persons who might be overlooked by neglecting these types would be very small.

The percentage of persons having the forms A, C or D in the throat or nose is, as already stated, 1.39 per cent. in the east, and 2.89 per cent., including Minnesota. These figures probably are not constant. Cultures from different classes of people would sometimes show different results. The results might be expected to vary in different years, depending in part on the prevalence of the disease of diphtheria and in part on factors as yet unknown. It might be said that at the time these investigations were made (1901) diphtheria had been unusually prevalent. It seems reasonable, however, to suppose that in Massachusetts about 1 to 2 per cent. of all persons carry typical diphtheria bacilli. Of this 1 to 2 per cent., not all are capable of transmitting the disease; for it is found that bacilli morphologically identical with diphtheria bacilli may have no power of producing toxins.

Virulence of the Diphtheria Bacilli Found in Healthy Persons.

As there are differences of opinion in regard to the value of the guinea pig test for virulence, due in part to a misunderstanding of the nature of the test, a word in explanation of the method employed seems desirable.

The test is usually made by growing the diphtheria bacilli in bouillon. Soluble toxins are formed in the bouillon, if the bacilli are virulent; and this bouillon inoculated into guinea pigs produces local lesions and the death of the animal, even if all the bacilli have been removed by filtration. The test, therefore, is not to see if the bacilli produce toxins in the guinea pig, but whether they will produce them in the bouillon. If there are toxins in the bouillon, we know that they will produce the characteristic lesions in the guinea pig; for the effect of the diphtheria toxins on guinea pigs is so constant that this animal is taken as a standard of measure of the strength of diphtheria toxins and antitoxins. Practically, all diphtheria bacilli from clinical cases produce toxins in bouillon; and there is no reason to believe — although this cannot be proved — that the converse is not true,— namely, that the bacilli which produce no toxins in bouillon will not produce them in human beings.

The number of virulence tests which were made in connection with these investigations was, unfortunately, small. More information on this point is needed.

Thirty-eight cultures of the *solid forms* were tested. In thirty-five the results were negative, while three showed virulence. The three positive tests were obtained by Gorham, reference to whose results has already been made.

One test of the *barred forms* was made. The result was negative.

Forty-seven tests of the *granular forms* were made. Thirty-nine proved to be non-virulent, eight (about 17 per cent.) were virulent.

While these investigations show that about 1 to 2 per cent. of all persons have typical Klebs-Loeffler bacilli, only about 17 per cent. of this 1 to 2 per cent. have virulent bacilli, or, in other words, 17 in 5,000 to 10,000 of all persons have diphtheria bacilli which are dangerous to the public health. The number of virulence tests

was too small to make the above percentages of much value, yet they bring out the fact that, if a healthy person is found to have Klebs-Loeffler bacilli, and there is no connection traceable between that person and cases of diphtheria, the chances are very much in favor of the bacilli being non-virulent. Great care should therefore be taken, we believe, not to put unnecessary restrictions on persons where the chances are great that the bacilli are non-virulent.

Diphtheria Bacilli in Persons Exposed to the Disease.

The investigations of the committee, except as already noted, do not cover the frequency of occurrence of diphtheria bacilli in exposed persons, but observations on this point are obtainable. Thus Park * found 50 per cent. of children exposed in New York tenements to have Klebs-Loeffler bacilli. Chapin,† in Providence, finds 16 per cent. of exposed persons to have the bacilli; Denny, ‡ in Brookline, 13 per cent.; Kober,§ in Breslau, 8 per cent.

It is found also that the bacilli in persons who have been in close contact with diphtheria are usually virulent. Thus Park in six cultures from exposed persons, Kober in fifteen, and Denny in seven, found all to be virulent.

From the above it is evident that the problem of what to do with a person who has been exposed to diphtheria is very different from what it is in the case of a non-exposed individual.

The bacilli found in healthy exposed persons are probably of the same virulence as those in the diseased individual, the absence of symptoms in the former being the result of an acquired or artificially produced immunity. A healthy person who has Klebs-Loeffler bacilli as a result of recent exposure is therefore as dangerous as a convalescent from diphtheria in whom the bacilli are persisting after all the local symptoms have disappeared.

It is therefore theoretically rational, if convalescents are isolated, to isolate also all healthy infected persons who have been exposed,

* American Text-book Practical Medicine, vol. i. p. 647.

† Reports of Superintendent of Health, Providence, R.I.

‡ Board of Health Report of Brookline, Mass., 1900.

§ Kober, Zeitschrift f. Hygiene, 1899, Bd. xxxi.

until they are free from bacilli. Such a course would undoubtedly result in preventing the occurrence of some cases and in saving some lives. It is found, however, that such a course is not practicable for all boards of health to follow. It is largely an economic question. The risk to the public health must be weighed against the loss and privation to the individual from isolation.

(Signed)

CHARLES V. CHAPIN,
Superintendent of Health, Providence, R.I., Chairman of the Committee.

HIBBERT WINSLOW HILL,
Bacteriologist, Boston (Mass.) Board of Health, Secretary of the Committee.

SAMUEL W. ABBOTT,
Secretary, Massachusetts State Board of Health.

F. H. BAKER,
Bacteriologist, Worcester (Mass.) Board of Health.

FRANCIS P. DENNY,
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FREDERIC P. GORHAM,
Bacteriologist, Providence (R.I.) Board of Health; Associate Professor of Biology, Brown University.

WILLIAM H. GOVE,
Salem (Mass.) Board of Health.

ARTHUR HUDSON,
Bacteriologist, Newton (Mass.) Board of Health.

THOMAS B. SHEA,
Chief Medical Inspector, Boston (Mass.) Board of Health.

THEOBALD SMITH,
Bacteriologist, Massachusetts State Board of Health; Professor of Comparative Pathology, Harvard University.

F. F. WESBROOK,
Bacteriologist, Minnesota State Board of Health; Professor of Pathology and Bacteriology, University of Minnesota.

(Dr. Wesbrook modifies his assent as follows: for Conclusion II. he would substitute, "It may sometimes be impracticable to isolate from the public all the well persons in infected families, schools, and institutions, though it should be done as a routine if at all possible." He also adds, "Sometimes it is necessary to isolate, at least temporarily, patients who have sore throats in which types of bacilli not represented by A, C, and D are present.")

Tables showing the results of the work done are appended.

TABLE I.

SHOWING PERSONS INFECTED WITH A, C, D ("TYPICAL *B. diphtheriæ*").

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	TOTAL IN EAST.	MINNESOTA. Bethany Hospital.	MINNESOTA. Old Ladies' Home.	MINNESOTA. Owatonna.	MINNESOTA. Red Wing.	MINNESOTA. Catholic Orphan Asylum.	MINNESOTA. Park Rapids School.	MINNESOTA. TOTAL IN MINNESOTA.	GRAND TOTAL.
Nose only.																			
A	0	0	0	0	0	0	0	0	2	2	4	1	0	1	0	0	1	3	7
C	0	0	0	0	0	0	0	0	2	2	4	0	1	1	0	0	0	2	6
D	0	0	2	0	0	0	1	1	0	8	12	6	0	2	0	0	6	14	26
A, C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
A, D	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	2
C, D	0	0	0	1	0	0	1	1	0	1	4	2	0	1	3	1	2	9	13
A, C, D	0	0	0	0	0	0	0	0	0	0	0	1	2	1	2	0	0	6	6
Total nose only	0	0	2	1	0	0	2	2	4	13	24	11	3	6	5	1	11	37	61
Throat only.																			
A	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	3
C	0	0	0	0	0	1	0	0	0	2	3	0	0	0	0	0	0	0	3
D	0	0	0	0	0	1	0	0	0	2	3	1	1	0	3	1	2	8	11
A, C	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
A, D	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	1	1	3
C, D	0	0	1	0	0	0	0	0	0	1	2	2	0	2	1	0	0	5	7
A, C, D	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	0	2	7	7
Total throat only	0	0	1	1	0	2	0	0	0	10	14	4	2	3	6	1	5	21	35
Nose and Throat.																			
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0	0	0	2	3
D	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	3
A, C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A, D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C, D	0	0	0	0	0	0	0	0	0	0	0	4	0	1	3	0	0	8	8
A, C, D	0	0	0	1	0	0	0	0	0	0	1	2	0	1	8	0	1	12	13
Total nose and throat	0	0	0	1	0	0	0	0	0	4	5	6	0	4	11	0	1	22	27
Grand total (A, C, D)	0	0	3	3	0	2	2	2	4	27*	43	21	5	13	22	2	17	80	123
Reported positive	0	0	3	3	3	50*	3	3	84*	9					not	giv	en		
Total persons examined,	50	63	82	129	185	221	250	297	927	892	3,096	102	42	247	382	65	316	1,154	4,250

* The Providence results show particularly well how varied the numbers reported as "positive" may be according to the types regarded as important. Thus on the basis of the committee's belief that A, C, D, should be considered chiefly or solely, Providence would show .43% positives. If all granular and barred but not solid forms be included, as Professor Gorham, of Providence, states there would be about 3% positives. If all forms be included, there would be about 25%. The number actually reported makes about 9%. In Washington the positives formed .9% on the committee's standard; but 22% were actually reported positive. In Boston, on the committee's standard, 3.02% were positive; but only 1% were so reported.

TABLE II.

Showing Percentages of Persons Infected with A, C, D ("Typical *B. diphtheriæ*").

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota. Bethany Hospital.	Old Ladies' Home.	Owatonna.	Red Wing.	Catholic Orphan Asylum.	Park Rapids.	Total in Minnesota.	Grand Total.
Persons examined	50	63	82	129*	185	221	250	297	927	892*	3,096	102	42	247	382	65	316	1,154	4,250
Percentage of total persons infected	0	0	3.66	2.32	0	0.90	0.80	0.67	0.43	3.02	1.39	20.59	11.90	5.26	5.76	3.07	5.38	6.93	2.89
Percentage of persons showing nose only infected	0	0	2.44	0.77	0	0	0.80	0.67	0.43	1.45	.77	10.78	7.14	2.02	1.30	1.53	3.48	3.20	1.43
Percentage throat only infected	0	0	1.22	0.77	0	0.90	0	0	0	1.12	.45	3.92	4.76	1.01	1.59	1.53	1.58	1.82	0.82
Percentage both nose and throat infected	0	0	0	0.77	0	0	0	0	0	0.45	.16	5.88	0	2.23	2.87	0	0.32	1.90	0.63
Percentage of persons showing nose infected with or without concurrent throat infection	0	0	2.44	1.54	0	0	0.80	0.67	0.43	1.90	.93	16.66	7.14	4.25	4.17	1.53	3.80	5.11	2.07
Percentage of persons showing throat infection with or without concurrent nose infection	0	0	1.22	1.54	0	0.90	0	0	0	1.57	.61	9.80	4.76	3.24	4.46	1.53	1.90	3.72	1.46
Percentage reported positive	0	0	3.66	2.32	1.62	22.6	1.20	1.00	9.06	1.01					not given				

* Some cases examined in Boston, Brookline, and New York, were omitted from this table because of certain omissions in their records.

The records permit, however, their addition here, which would make the percentages as follows: —

Boston: total examined (nose and throat, including 892 given above), 991; total infected (A, C, D), 2.82%; nose only, 1.41%; throat only, 1.01%; both, 0.41%: total persons with nose infected, 1.81%; total persons with throat infected, 1.41%; total reported positive, 10 = 1.01%.

Brookline (exclusive of 129 given above): nose and throat culture in same tube, 687; total infected (A, C, D), 17 = 2.47%: throat only examined, 253; total infected (A, C, D), 6 = 2.37%. All infected with A, C, D, were reported positive.

New York: throat only examined, 200; total infected (A, C, D), 13 = 6.5%. All infected with A, C, D, were reported positive.

The persons examined, as recorded above in the Willard State Hospital, and those given in the foot-note in Brookline and New York, as well as all except the Catholic Orphan Asylum in Minnesota, had been more or less exposed to diphtheria.

TABLE III.

SHOWING NUMBER OF TIMES EACH TYPE WAS FOUND IN A NOSE, THE CORRESPONDING THROAT BEING FREE OF ALL TYPES. *Since two or more types sometimes occurred in one nose, the total of times any one type was found does not correspond with the total noses infected.*

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Minnesota.
A	0	None of the types reported.	0	0	0	0	0	Types not minutely recorded.	2	2	8
A^1	0		0	0	0	0	0		2	0	4
A^2	0		0	0	0	0	0		2	0	1
B	0		1	0	0	0	0		0	0	0
B^1	0		0	0	0	0	0		0	0	0
B^2	0		0	0	0	0	0		0	2	0
C	0		0	1	0	0	1		2	3	12
C^1	0		0	1	0	2	1		11	4	27
C^2	0		1	22	1	0	1		87	1	25
D	0		2	1	0	0	1		0	8	23
D^1	1		0	3	0	0	2		3	139	97
D^2	4		2	36	11	0	4		123	274	207
E	0		0	0	0	2	0		0	2	26
E^1	0		0	0	0	2	0		1	7	13
E^2	5		0	15	12	35	0		4	5	241
F	0		0	0	1	0	0		0	1	0
F^2	0		0	0	2	0	0		0	0	3
G	0		0	0	0	0	0		0	0	4
G^2	1		0	0	1	3	0		0	9	34
Total noses infected (throat uninfected)	8	0	2	42	21	44	6	92	189	351	283
Total number examined,	50	63	82	129	185	221	250	297	927	892	1,154

TABLE IV.

Showing Number of Times Each Type was found in a Throat, the Corresponding Nose being free of all Types. (See italics, Table III.)

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Minnesota.
A	0	None of the types reported.	0	1	0	0	0	Types not minutely recorded.	0	3	2
A^1	0		0	0	0	0	0		0	2	2
A^2	0		0	0	0	0	0		0	0	0
B	0		1	0	0	0	0		0	0	0
B^1	0		0	0	0	0	0		0	0	0
B^2	0		0	0	0	0	0		0	0	0
C	0		1	1	0	0	0		0	1	9
C^1	0		0	0	0	0	0		1	0	4
C^2	0		0	1	1	0	0		11	0	1
D	0		1	0	0	1	0		0	3	14
D^1	0		0	0	0	0	0		0	1	13
D^2	1		0	3	11	0	0		2	5	33
E	0		0	0	0	0	0		0	0	9
E^1	0		0	0	1	0	0		0	0	0
E^2	0		0	1	9	3	0		0	0	36
F	0		0	0	0	1	0		0	0	2
F^2	0		0	0	0	0	0		0	0	1
G	0		0	0	0	0	0		0	0	3
G^2	0		0	0	1	0	0		0	1	4
Total throats infected (noses uninfected)	1	0	1	4	13	5	0	4	12	11	48
Total examinations	50	63	82	129	185	221	250	297	927	892	1,154

TABLE V.

Showing Number of Times Each Type was found in a Nose, the Corresponding Throat being also Infected, but not with the Same Type. (See italics, Table III.)

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Minnesota.
A	0	None of the types reported.	0	1	0	0	0	Types not minutely recorded.	0	0	9
A^1	0		0	0	0	0	0		0	0	2
A^2	0		0	0	0	0	0		0	0	0
B	0		0	0	0	0	0		0	1	2
B^1	0		0	0	0	0	0		0	0	6
B^2	0		0	0	0	0	0		0	0	0
C	0		0	0	0	0	0		0	0	25
C^1	0		0	0	0	0	0		3	0	28
C^2	0		0	1	0	0	0		1	0	16
D	0		0	0	0	0	0		0	1	26
D^1	0		0	0	0	0	0		2	12	73
D^2	1		0	1	2	0	0		13	12	135
E	0		0	0	0	0	0		0	1	9
E^1	0		0	0	0	0	0		0	0	11
E^2	1		0	0	1	3	0		0	3	131
F	0		0	0	0	0	0		0	0	0
F^2	0		0	0	0	0	0		0	0	3
G	0		0	0	0	0	0		0	0	2
G^2	0		0	0	0	0	0		0	4	22
Total noses infected when throats had other types	1	0	0	3	2	3	0	0	12	22	150
Totals	50	63	82	129	185	221	250	297	927	892	1,154

TABLE VI.

Showing Number of Times Each Type was found in a Throat, the Corresponding Nose being also Infected, but not with the Same Type. (See italics, Table III.)

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Minnesota.
A	0	None of the types reported.	0	1	0	0	0	Types not minutely recorded.	0	2	11
A^1	0		0	0	0	0	0		0	0	4
A^2	0		0	0	0	0	0		0	0	1
B	0		0	0	0	0	0		0	0	1
B^1	0		0	0	0	0	0		0	0	11
B^2	0		0	0	0	0	0		0	0	0
C	0		0	0	0	1	0		0	2	17
C^1	0		0	0	0	0	0		3	0	6
C^2	0		0	2	0	0	0		9	0	7
D	0		0	1	0	0	0		0	2	11
D^1	0		0	0	1	0	0		1	1	56
D^2	0		0	1	2	0	0		4	15	99
E	0		0	1	0	0	0		0	1	4
E^1	0		0	0	0	1	0		0	0	7
E^2	1		0	0	1	0	0		0	0	83
F	0		0	0	0	1	0		0	0	2
F^2	0		0	0	0	0	0		0	0	4
G	0		0	0	0	0	0		0	0	3
G^2	0		0	0	0	1	0		0	2	9
Total throats infected when noses had other types	1	0	0	3	2	3	0	0	12	22	150
Total examined	50	63	82	129	185	221	250	297	927	892	1,154

TABLE VII.

SHOWING NUMBER OF TIMES EACH TYPE WAS FOUND IN BOTH THE NOSE AND THROAT OF THE SAME PERSON. (See italics, Table III.)

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Minnesota.
A	0	None of the types reported.	0	0	0	0	0	Types not minutely recorded.	0	0	2
A^1	0		0	0	0	0	0		0	0	0
A^2	0		0	0	0	0	0		0	0	0
B	0		0	0	0	0	0		0	0	0
B^1	0		0	0	0	0	0		0	0	0
B^2	0		0	0	0	0	0		0	0	0
C	0		0	1	0	0	0		0	1	4
C^1	0		0	0	0	0	0		1	0	2
C^2	0		0	1	1	0	0		3	0	3
D	0		0	0	0	0	0		0	3	2
D^1	0		0	0	0	0	0		0	3	10
D^2	2		0	3	2	1	0		4	25	36
E	0		0	0	0	0	0		0	0	0
E^1	0		0	0	0	0	0		0	0	2
E^2	1		0	1	2	1	0		0	0	38
F	0		0	0	0	0	0		0	0	0
F^2	0		0	0	0	0	0		0	0	2
G	0		0	0	0	0	0		0	0	0
G^2	0		0	0	0	0	0		0	1	1
Total persons with both noses and throats infected with same type,	2	0	0	3	3	2	0	20	7	30	45
Total examined . .	50	63	82	129	185	221	250	297	927	892	1,154

TABLE VIII.

Showing Number of Times Each Type was found in a Person, in Nose, Throat, or Both. (The sum of Tables III., IV., V., VI., VII.)

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Minnesota.
A	0	None of the types reported.	0	3	0	0	0	Types not minutely recorded.	2	7	32
A^1	0		0	0	0	0	0		2	2	12
A^2	0		0	0	0	0	0		2	0	2
B	0		2	0	0	0	0		0	1	3
B^1	0		0	0	0	0	0		0	0	17
B^2	0		0	0	0	0	0		0	2	0
C	0		1	3	0	1	1		2	7	67
C^1	0		0	1	0	2	1		19	4	67
C^2	0		1	27	3	0	1		111	1	52
D	0		3	2	0	1	1		0	17	76
D^1	1		0	3	1	0	2		6	156	249
D^2	8		0	44	28	1	4		146	331	510
E	0		2	1	0	2	0		0	4	48
E^1	0		0	0	1	3	0		1	7	33
E^2	8		0	17	25	42	0		4	8	529
F	0		0	0	1	2	0		0	1	4
F^2	0		0	0	2	0	0		0	0	13
G	0		0	0	0	0	0		0	0	12
G^2	1		0	0	2	4	0		0	17	70
Total persons infected in either nose or throat or both with any of the types,	13	0	3	55	41	57	6	116	232	436	676
Total examined . .	50	63	82	129	185	221	250	297	927	892	1,154

TABLE IX.

Showing Number of Times Each Type was found in a Nose, without regard to the Findings in the Corresponding Throat. (The sum of Tables III., V., VII.)

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Total in Both.
A	0	None of the types reported.	0	1	0	0	0	Types not minutely recorded.	2	2	5	19	24
A^1	0		0	0	0	0	0		2	0	2	6	8
A^2	0		0	0	0	0	0		2	0	2	1	3
B	0		1	0	0	0	0		0	1	2	2	4
B^1	0		0	0	0	0	0		0	0	0	6	6
B^2	0		0	0	0	0	0		0	2	2	0	2
C	0		0	2	0	0	1		2	4	9	41	50
C^1	0		0	1	0	2	1		15	4	23	57	80
C^2	0		1	24	2	0	1		91	1	120	44	164
D	0		2	1	0	0	1		0	12	16	51	67
D^1	1		0	3	0	0	2		5	154	165	180	345
D^2	7		0	40	15	1	4		140	311	518	378	896
E	0		2	0	0	2	0		0	3	7	35	42
E^1	0		0	0	0	2	0		1	7	10	26	36
E^2	7		0	16	15	39	0		4	8	89	410	499
F	0		0	0	1	0	0		0	1	2	0	2
F^2	0		0	0	2	0	0		0	0	2	8	10
G	0		0	0	0	0	0		0	0	0	6	6
G^2	1		0	0	1	3	0		0	14	19	57	76
Total noses infected	11	0	2	48	26	49	6	112	208	403	865	478	1,343
Total noses examined	50	63	82	129	185	221	250	297	927	892	2,799*	1,154	3,953

* Omitting Waltham (297) because of incomplete classification of types.

TABLE X.

SHOWING NUMBER OF TIMES EACH TYPE WAS FOUND IN A THROAT, WITHOUT REGARD TO THE FINDINGS IN THE CORRESPONDING NOSE. (The sum of Tables IV., VI., VII., WITH THE ADDITION OF NEW YORK.)

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	New York, N.Y.	TOTAL IN EAST.	Minnesota.	TOTAL IN BOTH.
A	0	None of the types reported.	0	2	0	0	0	Types not minutely recorded.	0	5	3	10	15	25
A^1	0		0	0	0	0	0		0	2	1	3	6	9
A^2	0		0	0	0	0	0		0	0	3	3	1	4
B	0		1	0	0	0	0		0	0	3	4	1	5
B^1	0		0	0	0	0	0		0	0	0	0	11	11
B^2	0		0	0	0	0	0		0	0	3	3	0	3
C	0		1	2	0	1	0		0	4	12	20	30	50
C^1	0		0	0	0	0	0		5	0	3	8	12	20
C^2	0		0	4	2	0	0		23	0	14	43	11	54
D	0		1	1	0	1	0		0	8	9	20	27	47
D^1	0		0	0	1	0	0		1	5	3	10	79	89
D^2	3		0	7	15	1	0		10	45	7	88	168	256
E	0		0	1	0	0	0		0	1	2	4	13	17
E^1	0		0	0	1	1	0		0	0	0	2	9	11
E^2	2		0	2	12	4	0		0	0	27	47	157	204
F	0		0	0	0	2	0		0	0	3	5	4	9
F^2	0		0	0	0	0	0		0	0	1	1	7	8
G	0		0	0	0	0	0		0	0	0	0	6	6
G^2	0		0	0	1	1	0		0	4	0	6	14	20
Total throats infected	4	0	1	10	18	10	0	24	31	63	20	161	243	404
Total throats examined	50	63	82	129	185	221	250	297	927	892	200	2,999*	1,154	4,153

*Omitting Waltham (297) because of incomplete classification of types.

TABLE XI.

Showing Number of Times any Representative of the Groups of Types given was Found: (1) in the Nose, (2) in the Throat. *Since two or more representatives of the same group sometimes occurred in one nose (or throat), the total of times representatives of a group was found is in excess of the total noses (or throats) infected.* (This Table is based on Tables IX. and X., omitting New York and Waltham.)

Groups of Types.	Times Found in Nose.						Times Found in Throat.					
	Total in East.	% in East.	Total in Minnesota.	% in Minnesota.	Total in Both.	% in Both.	Total in East.	% in East.	Total in Minnesota.	% in Minnesota.	Total in Both.	% in Both.
Total examined .	2,799		1,154		3,953		2,799		1,154		3,953	
A, C, D	30	1.07	111	9.65	141	3.58	26	0.91	72	6.26	98	2.48
Other granular . .	11	0.39	43	3.73	54	1.36	5	0.18	24	2.08	29	0.73
Barred	200	7.14	275	23.91	475	12.02	16	0.57	117	10.17	133	3.36
Solid	752	26.85	898	78.08	1,650	41.77	136	4.85	358	31.13	494	12.50

TABLE XII.

Showing the Results of the Tests for Virulence.

	Persons Not Exposed.						More or Less Exposed.				Definitely Exposed.		
	Results Positive.						Results Positive.				Results Positive.		
	Brookline, Mass.	Boston, Mass.	Lowell, Mass.	Providence, R.I.	Waltham, Mass.	Total.	Brookline, Mass.	New York, N.Y.	Willard State Hospital, N.Y.	Total.	Brookline, Mass.	Total.	Grand Total.
Granular	2	0	0	0	0	2	0	3	0	3	3	3	8
Barred	0	0	0	0	0	0	0	0	0	0	0	0	0
Solid	0	0	0	3	0	3	0	0	0	0	0	0	3
						5				3		3	11
	Results Negative.						Results Negative.				Results Negative.		
Granular	8	12	0	0	2	22	5	10	2	17	0	0	39
Barred	1	0	0	0	0	1	0	0	0	0	0	0	1
Solid	13	2	1	9	2	27	0	8	0	8	0	0	35
						50				25		0	75

TABLE XIII.—1. Showing Distribution of A in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types)	0	0	0	0	0	0	0	0	2	2	4	8	12
Present in throat (nose free of all types)	0	0	0	1	0	0	0	0	0	3	4	2	6
Present in both nose and throat . . .	0	0	0	0	0	0	0	0	0	0	0	2	2
Present in nose (with other types in throat)	0	0	0	1	0	0	0	0	0	0	1	9	10
Present in throat (with other types in nose)	0	0	0	1	0	0	0	0	0	2	3	11	14
Total number of times A was found present	0	0	0	3	0	0	0	0	2	7	12	32	44
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases Minnesota, State Board of Health Biennial Report, 1899–1900, p. 645.												39%

TABLE XIII. 2. Showing Distribution of A^1 in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types)	0	0	0	0	0	0	0	0	2	0	2	4	6
Present in throat (nose free of all types)	0	0	0	0	0	0	0	0	0	2	2	2	4
Present in both nose and throat . . .	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	0	0	2	2
Present in throat (with other types in nose)	0	0	0	0	0	0	0	0	0	0	0	4	4
Total number of times A^1 was found present	0	0	0	0	0	0	0	0	2	2	4	12	16
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												10%

TABLE XIII.—3. Showing Distribution of A^2 in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types)	0	0	0	0	0	0	0	0	2	0	2	1	3
Present in throat (nose free of all types)	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in both nose and throat	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in throat (with other types in nose)	0	0	0	0	0	0	0	0	0	0	0	1	1
Total number of times A^2 was found present	0	0	0	0	0	0	0	0	2	0	2	2	4
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												18%

PLATE I.

FIG. 1. Type A. 1 to 2 μ thick, 3 to 6 μ long.
FIG. 2. Type A^1. 1 to 2 μ thick, 3 to 6 μ long.
FIG. 3. Type A^2. 1 to 2 μ thick, 3 to 6 μ long.

The granules in A (Fig. 1) are reddish.

(This and the following plates represent, in black and white, *B. diphtheriæ* from serum cultures twelve to twenty-four hours old, stained with Loeffler's methylene blue. The reddish tint of the granules in types A, C, D, E, F, and G, noted under their respective figures, is an example of the metachromatism, well known as occurring in *B. diphtheriæ*, and certain other bacterial species. The plates are here reproduced, with the courteous permission of Dr. Wesbrook, from his original colored drawings. Colored reproductions are given in the Trans. Amer. Phys. 1900 and the Report of the Minnesota State Board of Health, 1899–1900.)

TABLE XIII.—4. Showing Distribution of B in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types) .	0	0	1	0	0	0	0	0	0	0	1	0	1
Present in throat (nose free of all types)	0	0	1	0	0	0	0	0	0	0	1	0	1
Present in both nose and throat	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	1	1	2	3
Present in throat (with other types in nose)	0	0	0	0	0	0	0	0	0	0	0	1	1
Total number of times B was found present	0	0	2	0	0	0	0	0	0	1	3	3	6
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												3%

TABLE XIII.—5. Showing Distribution of B^1 in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types) .	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in throat (nose free of all types) .	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in both nose and throat	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	0	0	6	6
Present in throat (with other types in nose)	0	0	0	0	0	0	0	0	0	0	0	11	11
Total number of times B^1 was found present	0	0	0	0	0	0	0	0	0	0	0	17	17
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												11%

TABLE XIII.—6. Showing Distribution of B^2 in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types)	0	0	0	0	0	0	0	0	0	2	2	0	2
Present in throat (nose free of all types)	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in both nose and throat	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in throat (with other types in nose)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total number of times B^2 was found present	0	0	0	0	0	0	0	0	0	2	2	0	2
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												3%

PLATE II.

FIG. 1. Type B. 0.5 μ thick, 3 to 7 μ long.
FIG. 2. Type B^1. 0.5 μ thick, 3 to 7 μ long.
FIG. 3. Type B^2. 0.5 μ thick, 3 to 7 μ long.

The granules in B (Fig. 1) are dark blue.

TABLE XIII.—7. SHOWING DISTRIBUTION OF C IN WELL PERSONS.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	TOTAL IN EAST.	Minnesota.	GRAND TOTAL.
Present in nose (throat free of all types) .	0	0	0	1	0	0	1	0	2	3	7	12	19
Present in throat (noses free of all types)	0	0	1	1	0	0	0	0	0	1	3	9	12
Present in both nose and throat . . .	0	0	0	1	0	0	0	0	0	1	2	4	6
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	0	0	25	25
Present in throat (with other types in nose)	0	0	0	0	0	1	0	0	0	2	3	17	20
Total number of times C was found present	0	0	1	3	0	1	1	0	2	7	5	67	82
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												66%

TABLE XIII.—8. SHOWING DISTRIBUTION OF C^1 IN WELL PERSONS.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	TOTAL IN EAST.	Minnesota.	GRAND TOTAL.
Present in nose (throat free of all types)	0	0	0	1	0	2	1	0	11	4	19	27	46
Present in throat (nose free of all types)	0	0	0	0	0	0	0	0	1	0	1	4	5
Present in both nose and throat	0	0	0	0	0	0	0	0	1	0	1	2	3
Present in nose (with other types in throat	0	0	0	0	0	0	0	0	3	0	3	28	31
Present in throat (with other types in nose)	0	0	0	0	0	0	0	0	3	0	3	6	9
Total number of times C^1 was found present	0	0	0	1	0	2	1	0	19	4	27	67	94
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												28%

TABLE XIII.—9. SHOWING DISTRIBUTION OF C^2 IN WELL PERSONS.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	TOTAL IN EAST.	Minnesota.	GRAND TOTAL.
Present in nose (throat free of all types)	0	0	1	22	1	0	1	0	87	1	113	25	138
Present in throat (nose free of all types)	0	0	0	1	1	0	0	0	11	0	13	1	14
Present in both nose and throat	0	0	0	1	1	0	0	0	3	0	5	3	8
Present in nose (with other types in throat)	0	0	0	1	0	0	0	0	1	0	2	16	18
Present in throat (with other types in nose)	0	0	0	2	0	0	0	0	9	0	11	7	18
Total number of times C^2 was found present	0	0	1	27	3	0	1	0	111	1	144	52	196
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												5%

PLATE III.

FIG. 1. Type C. 0.5 to 1 μ thick, 3 to 6 μ long.
FIG. 2. Type C^1. 0.5 to 1 μ thick, 3 to 6 μ long.
FIG. 3. Type C^2. 0.5 to 1 μ thick, 3 to 4 μ long.

The granules in C (Fig. 1) are reddish.

TABLE XIII.—10. Showing Distribution of D in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types)	0	0	2	1	0	0	1	0	0	8	12	23	35
Present in throat (nose free of all types)	0	0	1	0	0	1	0	0	0	3	5	14	19
Present in both nose and throat	0	0	0	0	0	0	0	0	0	3	3	2	5
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	1	1	26	27
Present in throat (with other types in nose)	0	0	0	1	0	0	0	0	0	2	3	11	14
Total number of times D was found present	0	0	3	2	0	1	1	0	0	17	24	76	100
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												83%

TABLE XIII.—11. Showing Distribution of D^1 in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (tnroat free of all types)	1	0	0	3	0	0	2	0	3	139	148	97	245
Present in throat (nose free of all types)	0	0	0	0	0	0	0	0	0	1	1	13	14
Present in both nose and throat	0	0	0	0	0	0	0	0	0	3	3	10	13
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	2	12	14	73	87
Present in throat (with other types in nose)	0	0	0	0	1	0	0	0	1	1	3	56	59
Total number of times D^1 was found present	1	0	0	3	1	0	2	0	6	156	169	249	418
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												32%

TABLE XIII.—12. Showing Distribution of D^2 in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types) .	4	0	0	36	11	0	4	0	123	274	452	207	659
Present in throat (nose free of all types)	1	0	0	3	11	0	0	0	2	5	22	33	55
Present in both nose and throat	2	0	0	3	2	1	0	0	4	25	37	36	73
Ptesent in nose (with other types in throat)	1	0	0	1	2	0	0	0	13	12	29	135	164
Present in throat (with other types in nose)	0	0	0	1	2	0	0	0	4	15	22	99	121
Total number of times D^2 was found present	8	0	0	44	28	1	4	0	146	331	562	510	1,072
Total uumber of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												55%

PLATE IV.

FIG. 1. Type D. 0.75 to 1 μ thick, 2 to 3 μ long.
FIG. 2. Type D^1. 0.5 to 1 μ thick, 2 to 3 μ long.
FIG. 3. Type D^2. 0.75 to 1 μ thick, 1 to 2.5 μ long.

The granules in D (Fig. 1) are reddish.

TABLE XIII.—13. SHOWING DISTRIBUTION OF E IN WELL PERSONS.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	TOTAL IN EAST.	Minnesota.	GRAND TOTAL.
Present in nose throat free of all types) .	0	0	2	0	0	2	0	0	0	2	6	26	32
Present in throat (nose free of all types)	0	0	0	0	0	0	0	0	0	0	0	9	9
Present in both nose and throat	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	1	1	9	10
Present in throat (with other types in nose)	0	0	0	1	0	0	0	0	0	1	2	4	6
Total number of times E was found present	0	0	2	1	0	2	0	0	0	4	9	48	57
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												49%

TABLE XIII.—14. SHOWING DISTRIBUTION OF E[1] IN WELL PERSONS.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	TOTAL IN EAST.	Minnesota.	GRAND TOTAL.
Present in nose (throat free of all types)	0	0	0	0	0	2	0	0	1	7	10	13	23
Present in throat (nose free of all types)	0	0	0	0	1	0	0	0	0	0	1	0	1
Present in both nose and throat	0	0	0	0	0	0	0	0	0	0	0	2	2
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	0	0	11	11
Present in throat (with other types in nose)	0	0	0	0	0	1	0	0	0	0	1	7	8
Total number of times E[1] was found present	0	0	0	0	1	3	0	0	1	7	12	33	45
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												44%

TABLE XIII.—15. SHOWING DISTRIBUTION OF E[2] IN WELL PERSONS.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	TOTAL IN EAST.	Minnesota.	GRAND TOTAL.
Present in nose (throat free of all types) .	5	0	0	15	12	35	0	0	4	5	76	241	317
Present in throat (nose free of all types) .	0	0	0	1	9	3	0	0	0	0	13	36	49
Present in both nose and throat	1	0	0	1	2	1	0	0	0	0	5	38	43
Present in nose (with other types in throat)	1	0	0	0	1	3	0	0	0	3	8	131	139
Present in throat (with other types in nose)	1	0	0	0	1	0	0	0	0	0	2	83	85
Total number of times E[2] was found present	8	0	0	17	25	42	0	0	4	8	104	529	633
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												39%

PLATE V.

Fig. 1.

Fig. 2.

Fig. 3.

FIG. 1. Type E. 0.5 to 0.75 μ thick, 1.5 μ long.
FIG. 2. Type E^1. 0.5 to 0.75 μ thick, 1.5 to 2 μ long.
FIG. 3. Type E^2. 0.5 to 0.75 μ thick, 1 to 2 μ long.

The granules in E (Fig. 1) are reddish.

TABLE XIII.—16. Showing Distribution of F in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types) .	0	0	0	0	1	0	0	0	0	1	2	0	2
Present in throat (nose free of all types) .	0	0	0	0	0	1	0	0	0	0	1	2	3
Present in both nose and throat	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in throat (with other types in nose)	0	0	0	0	0	1	0	0	0	0	1	2	3
Total number of times F was found present	0	0	0	0	1	2	0	0	0	1	4	4	8
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												2%

TABLE XIII.—17. Showing Distribution of F^2 in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types) .	0	0	0	0	2	0	0	0	0	0	2	3	5
Present in throat (nose free of all types) .	0	0	0	0	0	0	0	0	0	0	0	1	1
Present in both nose and throat . . .	0	0	0	0	0	0	0	0	0	0	0	2	2
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	0	0	3	3
Present in throat (with other types in nose)	0	0	0	0	0	0	0	0	0	0	0	4	4
Total number of times F^2 was found present	0	0	0	0	2	0	0	0	0	0	2	13	15
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												3%

TABLE XIII.—18. Showing Distribution of G in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types) .	0	0	0	0	0	0	0	0	0	0	0	4	4
Present in throat (nose free of all types)	0	0	0	0	0	0	0	0	0	0	0	3	3
Present in both nose and throat	0	0	0	0	0	0	0	0	0	0	0	0	0
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	0	0	2	2
Present in throat (with other types in nose)	0	0	0	0	0	0	0	0	0	0	0	3	3
Total number of times G was found present	0	0	0	0	0	0	0	0	0	0	0	12	12
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												4%

TABLE XIII.—19. Showing Distribution of G^2 in Well Persons.

	Ontario.	Newton, Mass.	Willard State Hospital, N.Y.	Brookline, Mass.	Springfield, Mass.	Washington, D.C.	Lowell, Mass.	Waltham, Mass.	Providence, R.I.	Boston, Mass.	Total in East.	Minnesota.	Grand Total.
Present in nose (throat free of all types) .	1	0	0	0	1	3	0	0	0	9	14	34	48
Present in throat (nose free of all types) .	0	0	0	0	1	0	0	0	0	1	2	4	6
Present in both nose and throat	0	0	0	0	0	0	0	0	0	1	1	1	2
Present in nose (with other types in throat)	0	0	0	0	0	0	0	0	0	4	4	22	26
Present in throat (with other types in nose)	0	0	0	0	0	1	0	0	0	2	3	9	12
Total number of times G^2 was found present	1	0	0	0	2	4	0	0	0	17	24	70	94
Total number of individuals examined .	50	63	82	129	185	221	250	297	927	892	3,096	1,154	4,250
Percentage of occurrence in clinical cases (throat only examined)	In 608 clinical cases in Minnesota.												4%

PLATE VI.

FIG. 1. Type F. 0.25 to 0.5 μ thick, 1 to 2 μ long.
FIG. 2. Type F^2. 0.25 μ thick, 1 to 2 μ long.
FIG. 3. Type G. 0.5 to 0.75 μ thick, 1 to 1.5 μ long.
FIG. 4. Type G^2. 0.5 to 0.75 μ thick, 1 to 1.25 μ long.

The granules in F (Fig. 1) and G (Fig. 3) are reddish.

The Chairman.— I am sorry to say we have but a few minutes more in which we can use the hall; but such a report as this should not fall without discussion, and the question is now open for discussion.

Dr. Hill.— Mr. Chairman and gentlemen, as the secretary of this committee, I owe you an apology for addressing you in the discussion; but there were certain points brought out by this report which it might be well to review.

The percentage of diphtheria bacilli found in well persons in Providence ran, according to the report, about 9 per cent. Professor Gorham, however, tells me that probably 25 per cent. more accurately represents the facts, if all types are considered. On the other hand, by confining ourselves to the specific types, A, C and D, Providence would run less than Boston, or about one-half of 1 per cent.

This report confirms in every way the theoretical considerations which have hitherto been entertained with regard to the isolation of patients, merely showing that some of those theoretical considerations cannot always be carried out in practice, at least at the present time. The careful consideration which, as secretary of the committee, I have been able to give the report for some time past, convinces me that no change of moment in Boston methods as conducted at present need result from adhering to the committee's recommendations. I think that perhaps this statement may be of some little interest to you, because various men have come to me, and said: "Boston is the largest place in the State, and the centre of the diphtheria of the State. [72 per cent. of the diphtheria of the State in 1900 occurred within ten miles of Boston.] We would like to know how this report is going to affect you." I have been able to tell them, conscientiously, that it need make no change in our methods. Although it is a report which upsets some previous ideas, and very rightly so, it does not necessarily affect us in practice here. What it may do for places where other procedures have been followed, I cannot say.

The Chairman.— It has been suggested that the discussion of this subject is of too great importance to be absolutely cut off, and

that at the next meeting it might be resumed; and I think this is a good suggestion. It is unfortunate that everything should be so good as to take the whole afternoon and to bring us down to five o'clock, when we must vacate the room, without having fully completed a discussion of these excellent papers. I want to say, before the adjournment, that, if any member should feel that it is strange that all the meetings are held in Boston, such member is reminded that it is solely because no invitations are given for the meetings to be held elsewhere; and it is better that we should hold them in Boston, perhaps, than not hold them at all. By the by-laws we must hold two of them in Boston; but the other two, the April and October meetings, should really be held in other parts of the State or in Providence, and I think most of the Association would be very glad to visit these places. Among my notes of things to mention this afternoon is one upon the selection of papers. One of the hardest things to do is to find living subjects, those which will entertain and interest the members most. It is not always easy for anybody to do. I assure you the committee would be greatly pleased if you were to suggest topics for discussion, subjects for papers, and those which you care most for, those which shall interest the larger part of the Association. I had not finished these notes when a member, much to my delight, came forward, and made a suggestion upon one of these topics, and that suggestion was this: that at some meeting the whole afternoon be devoted to questions from members of the Association concerning topics that they would like to hear discussed, questions which they would like to hear answered by those having had experience. It is an excellent suggestion, and it pleased me very much. I hope it will you. This gentleman was from Salem, one of the oldest and best cities of Massachusetts: therefore, it must be good. I want to ask the Association now if they are ready for the question as to whether it would be their pleasure at the very next meeting to have the time devoted to questions from the members of the Association.

Mr. Coffey.— Might I suggest that you have already appropriated some of the time of the next meeting to a discussion of these papers?

The CHAIRMAN.— Yes. While a portion of the meeting is already mortgaged, it still remains to be decided whether the Association will have the remainder of the meeting devoted to questions and answers,— questions proposed by the members of the Association. Those in favor will say aye.

The motion was adopted unanimously.

The CHAIRMAN.— It is a unanimous vote. The next meeting will be held, if you will permit us, at Gallup's Island; and you will be the guests, as usual, of the Boston Board of Health. Is there any other business to come before the meeting?

On motion of Dr. Chapin, of Providence, the Committee on Diphtheria Bacilli in Well Persons was continued, in order that it might take charge of the editing of the report for the *Journal*. The Association then adjourned.

JOURNAL OF THE

Massachusetts Association of Boards of Health.

ORGANIZED 1890.

[The Association as a body is not responsible for statements or opinions of any of its members.]

Vol. XII. October, 1902. No. 3.

JULY QUARTERLY MEETING

OF THE

Massachusetts Association of Boards of Health.

The quarterly meeting of the Massachusetts Association of Boards of Health was held at Gallup's Island, Boston Harbor, on Thursday, July 24, Dr. H. P. Walcott, President, in the chair.

The following gentlemen were elected members of the Association upon recommendation of the Executive Committee: —

C. S. Knight, M.D.	Westboro
Ross McPherson, M.D.	Cambridge
J. H. McGrath	Clinton
C. W. Stodder, M.D	Marshfield (post-office address, Marshfield Hills)
A. L. Shirley, M.D.	East Bridgewater
George E. Bolling	Brockton
J. Winthrop Spooner, M.D.	Hingham
Nathaniel Conant	Brookline
Charles H. Pearson	Brookline
A. L. McMillan, M.D.	Hanover
Edmund H. Stevens, M.D.	North Cambridge
Albert C. Aldrich	Somerville
Jacob S. Lincoln	Milton

The records of the April meeting were read and approved.

The President.— The Executive Committee have accepted for the next meeting of this Association, in October, an invitation given to them by the authorities of the town of Brookline.

The first business upon your programme is the discussion of the report of the Committee on Diphtheria Bacilli in Well Persons. Dr. Hill probably represents that committee, and we shall be very glad to hear from him.

Dr. Hill.— Mr. Chairman and gentlemen, owing to a variety of unforeseen occurrences, the report, which should have been in your hands at least a week ago, is still with the printer. The *Journal* itself has not yet been issued. I am afraid that it would be rather difficult to discuss the report, since you have been unable to see the report in the first instance. I don't know that there is anything I can say, unless there are questions with regard to the report. I should be pleased to answer any questions from what I can remember from the report.

The President.— Is there any member of the Association who desires to ask any questions upon the matter? Dr. Hill will answer anything that may be asked. Or is it the pleasure of the Association to make this a special business for the October meeting?

Dr. Durgin.— I would move that this discussion be taken up as the first business at the next quarterly meeting.

The motion was seconded and adopted.

The President.— In accordance with the announcement upon your programme various questions have been suggested for discussion at this meeting, and I will read them in the order in which they have been received: —

1. What is to be the policy of the State Board of Health with regard to the preparation and free distribution to boards of health throughout the State of antitoxine, in view of the recent action of the legislature?

2. How far away from a diphtheria and scarlet fever hospital is it suitable for a small-pox hospital to be located?

3. Should boards of health require the reporting of cases of chicken-pox?

4. Should boards of health make provision for the care and isolation in hospitals, when requested, of patients ill with measles?

Those are the only four questions which have been submitted for discussion at this meeting. In what order will you discuss these questions, gentlemen?

Dr. Durgin.— I move, Mr. Chairman, that the first question raised, being of most vital importance, be discussed first; and I hope that we may have that question answered by the President of the Association.

Mr. Coffey.— I second the motion.

Dr. Durgin.— It is moved and seconded that this question be answered by Dr. Walcott. [The motion was adopted.] It is so voted, and the President has the floor. [Applause.]

The President.— The question is, "What is to be the policy of the State Board of Health with regard to the preparation and free distribution to boards of health of antitoxine, in view of the recent action of the legislature?" The statement must be partly historical; and I shall endeavor to make it, of course, as little personal as possible.

I may call to the attention of the Association that there has been more or less discussion of this matter in the public press,— a discussion which has been limited entirely to the representatives of the Druggists' Association, so far as I am aware; for I assume that a recent communication by Mr. Canning in the *Transcript* is an official communication. I understand that he makes no question about his association with the Druggists' Association for the promotion of legislation in the interests of the druggists. In that paper there were various statements which do not seem to me correct; but there was one statement which I should like to meet, in the first place, and this is the statement that, after the general question of vaccination had been discussed before the Public Health Committee of the legislature and settled, some interested parties then introduced a bill for the

making of vaccine lymph by the State Board of Health. As a matter of fact, those two measures were introduced simultaneously. One measure did not depend upon the success or failure of the other. The measure for the production of vaccine lymph, which I hold in my hand, Senate Document No. 179, was referred to the Committee on Public Health on Feb. 3, 1902, long before the close of the hearing upon the subject introduced by the anti-vaccinationists; and it reads as follows: —

SENATE No. 179.

(To accompany the petition of Samuel H. Durgin that the State Board of Health be authorized to produce antitoxine and vaccine lymph. Public Health.)

AN ACT

Relative to the Production of Antitoxine and Vaccine Lymph, etc.

Be it enacted, etc.

SECTION 1. Section four of chapter seventy-five of the Revised Laws is amended by inserting after the word "institution," in the eleventh line thereof the words: — and may, for the free use of the people of the Commonwealth, produce and dispose of antitoxine and vaccine lymph.

SECT. 2. This act shall take effect upon its passage.

That proposed legislation was referred to the Committee upon Public Health, which, after a hearing or two and due consideration, reported that legislation was inexpedient.

At a later date, Mr. Adams, of Melrose, the chairman of the Committee on Appropriations, having had his attention called to the fact that a tuberculous cow, which had evidently been recently used for the purpose of producing vaccine lymph, had been found in one of the slaughter-houses of the Commonwealth, and had been found to be so grossly diseased that the inspector ordered it to be thrown at once into the rendering vat, again called the attention of the legislature to the necessity of some action. The matter was referred again to the Committee on Public Health, which at that time and for the first time during the session asked the opinion of the State Board of Health. A hearing was held, at which I personally, as representing the State Board of Health, went before the committee, and stated that this matter of producing vaccine lymph had been settled in almost all the civilized countries of the world in favor of a government supervision of it, for the reason that it was an article absolutely im-

possible of chemical analysis, that no examination extended beyond the individual specimen that might be submitted for examination, and that under those conditions it appeared to be essential that the whole process should be supervised by some authority from the beginning to the end, that that was practically the only protection which would be given to the public. Upon that statement, and some statements made by parties interested in the manufacture of vaccine lymph, the committee again took the matter under consideration. This was toward the end of the session. Three or four days before the final adjournment of the legislature the Public Health Committee recommended that the subject of producing vaccine be referred to the State Board of Agriculture, and the matter so stands.

Now to go back a few years, in 1894 or 1895, I am not quite certain which, the State Board of Health began an examination of the antitoxine products then for sale in the Boston market. They were found to be of such untrustworthy character that it seemed essential to the Board of Health in the exercise of its principal function, the protection of the health of the people of the Commonwealth, to see what could be done in the matter. We were dealing with an article which at that time had only recently been brought into general use. There were a great many questions with regard to its preparation which had not been answered anywhere. There was a great deal of question among intelligent men as to the value of the product. For every reason, then, it seemed to the Board of Health a sufficient justification for some intelligent investigation into the matter,— an investigation which was rendered very easy for us at that time because Dr. Theobald Smith had lately come to this part of the country to accept an appointment in Harvard College, and his services were available for the State Board of Health. With Dr. Smith's assistance an investigation was made of the whole matter of the production of antitoxine, which for thoroughness has not been surpassed anywhere; and I venture to say that the product which has been elaborated under Dr. Smith's superintendence has a character that is second to none produced anywhere in the world. At any rate, you gentlemen are familiar with what the product has accomplished; and in that direction it is not necessary for me to say anything more about it.

That preparation was begun under the general powers given to the board to protect the health of the people of this Commonwealth. We did not ask the permission of the legislature of Massachusetts to do it. We have never asked the permission of the legislature of Massachusetts to save human life: we have assumed there would be no question upon that subject. From time to time a statement has been made by the Board to the Committee on Appropriation of the manner in which the money appropriated for the use of the Board of Health should be spent. As you all know, at the beginning of the year the various State departments go before the Committee on Appropriations and explain the appropriations which they ask for. Beyond that committee there has never been any discussion in the legislature as to whether antitoxine was to be prepared or not. I would say that the Committee on Appropriations has always accepted without hesitation, as far as I know, the recommendations of the board, and has made the proper appropriation. The amount of money spent has averaged probably some five or six thousand dollars a year. In this last year, when the product of antitoxine and the use of antitoxine was somewhat less than in the preceding year, the board prepared and distributed 58,000 doses. That represents, as you see, a very small expense. The market value of that preparation, assuming the lowest price at which we find that it is sold in the city of Boston, would have been $87,000.

Now I think we probably should all agree that neither this community nor any community has a right to demand that the State should pay for the product which the public can get as easily, as promptly, and as safely at an establishment which makes an occupation of preparing and selling that drug. It should be remembered, however, that the Commonwealth has taken a very different position, with regard to a certain number of contagious diseases, from that which it has occupied with regard to disease in general. It has made it possible in the case of small-pox for anybody to go to the public authority and be vaccinated free of charge: no question has been asked about it; and yet the vaccine quill is sold in the druggist's shop, and the doctor stands ready for a reasonable compensation to apply it. In diphtheria you are dealing with a product which commands a price beyond the possibilities of purchase by the ordinary laboring

man. If you assume the presence of a case of diphtheria, in which you are going to use such doses as have been used by the best practitioners in this Commonwealth, 40,000 to 70,000 units, you have got entirely beyond the probability of any laboring man's purchasing this agent of immunity from disease. He has got to procure it free of charge from some one, and it is for the benefit of the whole community that he should procure it as soon as possible. By the lives so saved the whole of us are benefited and protected. For that reason the Board of Health has never had any question that it was performing a very simple part of its duty in manufacturing this article and distributing it as widely as possible through the agencies of the boards of health throughout this Commonwealth.

When, however, the question was brought up as to the production of vaccine lymph, I asked Dr. Durgin when he consulted me about this matter, long before the legislature came together and long before the question of the anti-vaccinationists had been considered by any committee in the legislature, to insert in his bill a provision for the manufacture of antitoxine. It seemed to me the time had come when it was well that the Commonwealth should take a position one way or the other in this matter. It had ceased to be a question of experiment. There is no question now that there are — I am very certain that Dr. Smith would agree with me — establishments in this country that can produce antitoxine, and can produce antitoxine of a sufficiently good quality. It is also true that antitoxine can be examined so as to determine, in rather large quantities, whether it is good antitoxine or bad antitoxine. Of course, behind all that would remain the question whether, if you depended entirely upon the sale in the open market, the poor man would get it as he ought to get it; but, at any rate, the time certainly had come when antitoxine and vaccine lymph should be put upon the same footing, and, therefore, the legislation before mentioned was asked for. Now the action of the legislature upon the face of it leaves the question in this position: They were expressly asked to authorize the manufacture of antitoxine; and they, with great deliberation, declined to authorize it. On the one hand, it is apparent to me that the withholding of that permission, when it comes to the expenditure of money at the State House, is generally construed to be a forbidding of the expenditure

of money. On the other hand, some members of the legislature say, "We didn't interfere with the practice, and therefore go on with your practice, even if it does mean the expenditure of money." In order to dispose of that part of the question, I will say that the Board of Health have determined to go on with the manufacture and distribution of antitoxine [applause] until they are restrained by some competent authority from so doing; and I should like to say that this unpaid board with great unanimity voted at their last meeting that they would personally contribute the money necessary to carry on this work if need be. [Applause.]

The production of vaccine lymph is, it seems to me, a far greater question than the production of the antitoxine of diphtheria simply for the reason, as I have already said, that there are absolutely no means of testing more than the individual specimen that is submitted to you; and that test would be a long one. There is no possibility of settling that question in an hour or a day or a week even: you can only settle it when the question ceases to be of any interest to the community. I think we may in that direction turn our attention for a moment to what is done in foreign countries. In Germany, where government is disposed to interfere to a far greater extent than we are supposed to on this side of the Atlantic, antitoxine is in the hands of a great commercial establishment. The government exercises a very rigorous supervision of all the methods of that manufacture, but it still leaves the business in private hands. On the other hand, the production of vaccine lymph is absolutely in the control of the government. They never have allowed that to go out of their control for the reason that every step of the process has got to be watched. In the first place, you have got to get a healthy calf; in the next place, you have got to get a set of clean men to do your work; and in the next place, the last place, you have got to remove it absolutely from the temptations of commerce. There must be no temptation whatever to keep a product that is inert or a product that has been improperly prepared. So long as you cannot correct the steps of that progress by any chemical or microscopical examination, you have got to depend upon authority, and you have got to depend upon authority exercised at every moment. There is no step of the process that can be safely left without constant and accurate supervision.

The expense which the State Board of Health estimated would attend this business was an appropriation of some $20,000 for the erection of a building sufficient, in the first place, to stable the animals; in the next place, to include all the biological laboratories which had got to be built with all the precaution that a biological laboratory for any purpose has got to be built; and, finally, the rooms for the storing and the housing of the people who are concerned in the distribution of this product. The Commonwealth has had the advantage thus far of a location upon the untaxed lands of Harvard College, at the Bussey Institute; and that location is still open to the Commonwealth without compensation, so that there is no sum of money included in this for the purpose of purchasing a lot of land. But it will be seen that the question was not of a place to house a certain number of calves or anything of that sort. It was a laboratory built according to modern methods, and with the expenditure of money, large expenditure of money, necessary for that purpose. It was also proposed, as our antitoxine establishment had outgrown its quarters, that that should be united with the vaccine establishment; that is, that we should give the antitoxine business a proper and convenient housing, which it has not hitherto had, and at the same time provide for the preparation of vaccine lymph. It was also estimated that the running expenses of that establishment would be about $6,000 a year. Now an original investment of $20,000 and an expense for maintenance of $6,000, when one of the products produced by that establishment in the last year had a market value of $87,000, would not seem a disadvantageous investment, even for the Commonwealth of Massachusetts.

That, gentlemen, is where the question stands at present. While the Board of Health is quite willing to take the position which it has taken for the present year with regard to the manufacture of antitoxine, with another legislature, and with a fuller discussion of this whole question, it must be remembered that the uncertainty cannot continue into another year, and that it really rests, I think, with this Association, with the local boards of health of this Commonwealth, as to what shall be done. It seems to me the opinion of this Association means more — it certainly does to me — than that of any other body of men in the Commonwealth; and, whatever the decision of this Association is, I, personally, shall stand by it. [Applause.]

Mr. Coffey.— I move the adoption of the following resolution: —

Resolved, That this Association fully indorses the decision of the State Board of Health to continue the production of antitoxine.

Dr. Durgin.— I second the motion.

The President.— You have heard the motion of Mr. Coffey. Is there anything to be said upon the subject?

Dr. Magee.— Mr. Chairman, I think we have touched on a very important subject this afternoon, one that ought not to be hastily gone over. Antitoxine is certainly important. Every man who is a practitioner of medicine knows what the State Board has done to save the lives of thousands of children. I should like to hear more discussion on the subject before it is passed. I should like to hear some other gentlemen.

Mr. Coffey.— Mr. President, in offering that resolution, I supposed, as the gentleman who has just sat down has said, that every man here who is connected with a board of health is fully aware of how much this antitoxine has done toward the diminution of diphtheria and the saving of life in this community. As I say, I supposed, as he has said, that every man knew that, that it was not necessary that it should be discussed or debated, that we were all aware of it, that it was a question that would pass without any discussion or debate, and that we simply put upon record our approval of the action of the State Board of Health in continuing the production of this antitoxine, that they may know that this Association, representing, as it does, the boards of health in the entire State, is fully in accord with and approves its action in continuing this work. I know in my own city we are indebted to the State Board of Health for antitoxine in practically unlimited quantities. We have a hospital for the care of diphtheria and scarlet fever, which is known as the isolation hospital; and there we take care of two hundred, three hundred, four hundred cases in the year, probably half of which are diphtheria. I know that our record there since the introduction of antitoxine has been marvellous: I think I may use that word with safety. We have reduced the rate of mortality in diphtheria to about 7 per cent., and that a few years ago would have been considered marvellous. When it is

considered that we don't force anybody to enter that hospital, that the applications and admissions are all voluntary, no person is forced to send his child there against his will, it will be seen that, as a result, a large proportion of the cases that we get are the very worst type of the disease. In fact, we get a great many cases in which the doctor tells the people, the parents, the friends, that "there is no hope for this child unless you send it to the isolation hospital, and possibly they may be able to pull it through." We get about all of the intubation cases, I think, almost without exception: once in a while one stays at home; but, as a rule, all the intubations go there. And so our rate, as I said before, I think is marvellous, considering that fact, that we do get those very worst cases, and get a very large proportion of them—in fact, nearly all. That is largely due to the unlimited use — that the Board of Health have made possible by their free gift — of antitoxine. We have used there as high as 50,000 and 60,000 units for a patient, with splendid results, too. A great many cases that have hovered between life and death for a week have finally pulled through. As I said before, when I introduced that resolution, I did not suppose that it was necessary to make any argument in support of it. The feeling that I had was that we might strengthen the hands of the State Board of Health, and make them feel that behind them was this organization, representing, as I said before, the entire boards of health of the State. [Applause.]

Dr. A. E. Miller.— Mr. President, it seems to me that as physicians here we are all of one mind. We are all in favor of this resolution. We might do a great deal as a body of medical men to impress the next legislature. It is not long before we are going to vote; and I think we can wake up the masses of the people, so that we can elect a legislature who will favor this next winter, and will give the State Board of Health an appropriation sufficiently large, not only to enable them to manufacture antitoxine, but to manufacture a sufficient amount of vaccine virus. Both of those articles should be furnished by the State and given to every practitioner free of charge. We have a law that compels — at least, that is being tested somewhat now — people to be vaccinated; and these people, if they are compelled to be vaccinated, ought to know that they are to be vaccinated with something that is furnished by the State Board, and is the purest

article that can possibly be had. We should all wake up on this point, and see if we can't get a body of men as a legislature next winter that will vote just right. [Applause.]

Dr. Magee.— Mr. Chairman, that was my object in getting up, to have the matter discussed. I think it is a very important matter to have the representatives to the General Court men whom we know, and to go to them and insist upon those men voting for what we ask. Not only that, but — I see there are very few members here to-day — the medical societies, the district societies, should be interested in this one subject. It is an important one. Every member here who belongs to a district society should bring the matter up. We should go to our representatives, ask them to do as we wish, and show them the reasons why this should be done. That was the reason why I wanted a little discussion on the matter.

Dr. Hill.— Mr. Chairman, we are all agreed that antitoxine is the thing. It may not be out of place to say that, being in charge of the laboratory of the Boston Board of Health, Boston physicians often come in and discuss with me whatever subjects may come up; and of course much of such discussion is on diphtheria. It is the universal impression that antitoxine is the thing to use. There cannot be any question in anybody's mind of its value in that direction. I would suggest as an amendment to the resolution, or an addition to it, if such is proper, a clause stating that the resolution shall be forwarded to the proper legislative authorities as the direct expression of the belief of this Association in the matter.

The President.— The legislature that it ought to be addressed to is not in existence.

Dr. Hill.— True, but it would be kept until the next session.

Mr. Coffey.— Mr. President, Dr. Durgin and myself discussed this somewhat while you were talking; and we thought that perhaps it would be wise to have this resolution adopted now, and then, at the January meeting or at the October meeting, probably at the January meeting, just about the time the legislature convened, a resolution might be introduced and passed that would embody not only antitoxine for diphtheria, but also vaccine lymph, and that the legislative committee of this Association might be instructed to go before the Committee on Public Health, or whatever committee would have

charge of the matter, and urge the appropriating of a certain amount of money, in order that the State Board might carry out those ideas. But we thought that perhaps just now it would not be amiss to have a resolution indorsing the stand of the Board of Health in determining to keep on with the manufacture of antitoxine, while the question of vaccine lymph we might allow to remain in abeyance until January, when the thing would be ripe for action.

Dr. Durgin.— I want to indorse what has been said by our President in regard to the letter to the *Transcript* by Mr. Canning and the action of the legislature on the production of vaccine lymph. I was greatly surprised on reading the letter of Mr. Canning night before last. I had supposed Mr. Canning to be better posted on the facts than appears from his letter. It is stated in this letter that "a bill for compulsory vaccination was asked for, and that, after the bill making vaccination compulsory had been signed, the views of the Board of Health representatives seemed to undergo a change, and it was pretended that it was necessary, in the interests of the public health, that the State Board of Health should be given the power to manufacture and give away vaccine virus." It would have been easy for Mr. Canning to learn that no compulsory vaccination bill was asked for, and that this law was already on the statute book and had been there for the last forty years. It would also have been easy for Mr. Canning to learn that, instead of one of these petitions following the other, they were both prepared and introduced in the legislature at the same time, so that no "change of mind" on the part of the boards of health mentioned happened or was thought of except by Mr. Canning and possibly some other disinterested druggists.

Mr. Canning states that a proposition for the State's "supplying milk, running milk farms, manufacturing ice, constructing ice factories, the establishment of a great laboratory for the production of pure bread, the production of pure flour, the production of drugs and medicines, quinine, and every other drug or medicine which the people need, would be no whit different from the manufacture and distribution of vaccine lymph." I think it might be fair to say that Mr. Canning knows that the State does not command the use of milk, ice, bread, flour, or quinine, and that she has never considered

that the public health required any legislation upon the subject. Mr. Canning ought to know that the State of Massachusetts, and almost the civilized world, has legislated upon the use of vaccine lymph as a public health measure and necessity, and has ordered its use. It ought not to be difficult for Mr. Canning to see a moral obligation on the part of the State to supply pure and active vaccine lymph the moment she issues her command for its use by her people. Would Mr. Canning or the other druggists question the right or obligation of the government's supplying the school-house and teacher, when it commands the education of the people as a safeguard of order and liberty, or do they see a whit's difference between the supplying of these and that of vaccine lymph, when the same government orders the use of vaccine lymph for the preservation of the public health? I think one of the most interesting things, however, in Mr. Canning's letter is the statement that "any opposition that was made by the druggists was made on principle, and not from interested motives." I would only say that this disinterested devotion to the public welfare, attended with so much expense and time on the part of the druggists, is a trifle phenomenal, and, if true, deserves more public recognition than has yet been given to it.

I hope the members of this Association will carefully consider, not only the clear obligation of the State in this matter, but the immense advantage in quieting the fears of our people as to the safety and activity of vaccine lymph by securing its preparation by our State Board of Health.

Dr. H. E. Marion.— Mr. Chairman, do I understand that this Canning who wrote the article in the *Advertiser* is of the firm of Canning & Patch, the druggists?

The President.— I think so.

Dr. H. E. Marion.— I thought that it would be well for every member of the Association to know the animus of that writer.

Dr. Chase.— Mr. President, may I inquire through you how many members of the Public Health Committee of the legislature are druggists? I understand that a number of the members are druggists. I should like to know how many.

Dr. Durgin.— I am told four or five.

Dr. Chase.— How large is that committee?

Dr. Durgin.— It has eleven members.

Dr. Stevens.— If it is in order, I should like to state my personal experience with vaccine. The last few weeks, as you know, we have had something of an epidemic of small-pox. In June, and up to the 15th of July, I procured 110 points, and used them in vaccinating people among my own patients. A very large proportion of these were revaccinations: some 12 were primary vaccinations. In not one instance have I had a successful vaccination from these 110 points,— not one instance, primary or secondary. I have procured since the 16th of July, from the same producer, points, and have vaccinated some of the people I tried before,— some of them I tried three times,— and in about 20 per cent. of them I have succeeded. The virus that I used first was dated good until August 5. The virus that I have been using lately was dated good until August 15. That that was marked good until August 5 absolutely failed. That that was marked good until August 15, an entirely new lot, seems to be succeeding. I don't know whether that is the general experience; but one of my neighbors, who has vaccinated very many more people than I have, told me that his experience had been exactly the same as mine, that he had only had one success with the virus marked good until August 5. It seems to me that it is pretty important, if you are going to vaccinate people, that we should have something that we can use as vaccine virus, and not a lymph that is inert,— and I believe that the vaccine to which I first referred was absolutely inert,— particularly in a town where small-pox is prevailing to a considerable extent.

Dr. Davenport.— The question has been asked how many of the Committee on Public Health were druggists. I should like to ask how many were practising physicians, if any.

Dr. Abbott.— None.

Dr. Davenport.— The statement has been made that Mr. Henry Canning was of the firm of Canning & Patch. There was formerly such a firm, but it no longer exists. Mr. Canning is now in business by himself.

Dr. H. E. Marion.— Drug business?

Dr. Davenport.— Yes. He is the Mr. Henry Canning of the former firm of Canning & Patch, who continues the drug business,

corner of Green and Chambers Streets. He is the same person who reports to the Secretary of the Commonwealth, under the so-called Lobby Act, that he has paid to Benjamin N. Johnson, Esq., $1,685.25 for services and expenses in opposing the bill authorizing the State Board of Health to manufacture antitoxine and vaccine virus under Senate Bill 179.

Dr. Durgin.— I was in New York a few days ago, and the health officer there told me that 144 immigrants had recently been vaccinated, with success in only 6. He revaccinated with virus which was produced by the New York Board of Health, and there was over 50 per cent. of success on these same individuals.

Mr. Coffey.— I want to add to that, Mr. Chairman, the fact that at Worcester we do a wholesale vaccinating business every year. We vaccinate from 2,500 to 3,000 children every year before they enter the public schools. We begin vaccinating the last of August, and keep it up every Monday morning during the year until the school year ends. We vaccinate, as I say, from 2,500 to 3,000 children every year; and the number is constantly increasing. We have tried a number of various vaccine lymphs on the market; and something over a year ago we began to use the vaccine lymph produced by the New York City Board of Health, with the best results that we have ever had from any vaccine that we have tried. Last summer, when we had a little outbreak of small-pox at the city hospital in Worcester, we vaccinated some 8,000 or 10,000 people with that lymph. Dr. Clark, who does the vaccinating and has done it for seven or eight years, says that the percentage of successful vaccination is very much greater than with any other lymph that he had previously used; and we have never had any bad arms or bad effects whatever from it. We have had, as I say, splendid results. They sell it to us cheaper than we bought some of the lymph that was put on the market by commercial firms. We paid formerly 7½ cents a point, and they furnish it to us for 6½ cents a point.

A Member.— Do you buy it direct from the board?

Mr. Coffey.—Buy it direct from the board. It is sent direct, and we get it usually twenty-four hours or surely forty-eight hours afterward. We have used in a year something like 12,000 or 15,000 tubes, and the physicians of Worcester now are using that largely.

We find that that gives better results. The physicians come to me very often and ask for that, when they have one or two private patients that they are anxious to have take.

A MEMBER.— Is that on the market?

MR. COFFEY.— Well, they sell it from the New York City Board of Health. They sell it to anybody who wants it. They make this, of course, for their own use in the city of New York; but they make more than they use, and they are ready to dispose of it. In an account in one of the magazines I happened to run on to it something over a year ago. I saw a description of the methods that they used in producing the lymph, and they struck me as being very painstaking. I suggested to Dr. Clark that we try it, as we were having trouble with some of the lymph that we were using at the time, having people who had been vaccinated come back for revaccination. He said, "All right," and sent for it with the result, as I say, that we have had splendid results from it. We have two nurses come down from the City Hospital and prepare the arms of the children by washing with a liquid soap and then subsequently with alcohol. We have done that for about a year or two years with, as I say, no evil results in the way of sore arms at all. No shields are used. A great many people who can well afford to pay for vaccination, I presume, come there; but we don't ask any questions. They come there, and we vaccinate them. We make them return, and look their arms over before we issue the school certificate. I don't know that we can ascribe to any other means the fact of Worcester's freedom from small-pox. Since last July we have had only three cases of small-pox in the city of Worcester, although it is, next to Boston, the largest city in the State, and all around us in the surrounding towns they have had a great deal of it,— towns that are connected with Worcester by trolley lines that are running in every half-hour or hour. We have only had, as I say, three cases of small-pox in about a year in the city of Worcester. I don't know what else to attribute it to except the thorough vaccination that is going on there. This began some years ago by starting with the vaccination of school-children in a small way; and it kept growing and growing until to-day, practically, I suppose, two-thirds or three-fourths of all the children that enter the public schools every fall are vaccinated at our office before they

enter. The school department works in harmony with us, because no child is admitted to the public schools without a certificate. They don't give them the billet in the office of the superintendent of schools without first sending them to the health office to see if they have been successfully vaccinated or not. I must say that children who have moved from some other cities and towns of the State to Worcester come in with certificates in their hands, signed by physicians, that they have been successfully vaccinated; and on investigation, making them strip and letting us see whether they have been or not, we fail to find any evidence whatever of successful vaccination, or of any vaccination, in a great many instances. I cannot account for that in any other way than that perhaps a physician will vaccinate a child, and then later the mother or father will come in and say it took all right; and he will sit down and write a certificate, and give it to the mother or father without seeing the child. But I want to say that no child is admitted to the schools of Worcester in that way. We must ourselves see every child, and every one comes into the office. They strip, and we see whether they are successfully vaccinated or not; and, unless they are, we don't issue the certificate, and the school department refuses to give a billet until the certificate has been issued.

Dr. Davenport.— Mr. Chairman, I should like to say a word in regard to the examination and vaccination of school-children. The board of health started in the town of Watertown last year to have the school inspectors make a personal examination of the arms of all the children in the schools, and prepare a card catalogue of the number and character of the vaccination scars found, primary or revaccinations, whether satisfactory, indifferent, or what they were, and to urge the revaccination of all such children as were found not to have been properly vaccinated. We had three inspectors in the schools. One of these inspectors co-operated heartily with the chairman of the board of health, who happened to be myself; and there was a good deal of vaccination and revaccination done in one of the three districts. The other two inspectors did not co-operate heartily. Although I had acted as chairman of the board of health for ten years, I am not now on the board. It was said that there was too much interference and too much zeal, although it was, of course,

without any personal interest, as I was not in practice in the town. We have had several cases of small-pox in the town. Some of them have been among school-children, but not in the well-vaccinated district. It has happened in some of the other districts. This card catalogue of the vaccination was to be kept on file in the office of the master or of the superintendent of schools, for convenient reference.

The President.— The question before you is the vote offered by Mr. Coffey. I don't understand Dr. Hill insists upon his amendment.

Dr. Hill.— No, I will withdraw it.

The vote offered by Mr. Coffey was adopted.

Dr. Magee.— Now, Mr. Chairman, with your permission, I would like to make a motion that the Secretary of this Association be instructed to communicate with the secretaries of the district medical societies of this State, asking them to take some action, and recommending the antitoxine of the State and also the matter of the free distribution of virus. I think in that way you will bring the discussion before the medical men of the State, who are very much interested in the matter; and in that way you will get good results. There might also be communications with the various boards of health.

Dr. A. E. Miller.— Mr. President, I desire to second that motion.

The President.—It is moved and seconded that there be an official communication from this Association to the respective district medical societies of the State upon the subject of the production of antitoxine and vaccine lymph. If that be your pleasure, signify it by saying aye.

The motion was adopted.

The President.— It is so voted. The next question before you is the answer to the question,—

How far away from a diphtheria and scarlet fever hospital is it necessary for a small-pox hospital to be located?

I know of no one better able to answer that question than Dr. Abbott.

Dr. Abbott.— This question came in on Tuesday; and I have looked up the subject somewhat, Mr. Chairman, since that time. In considering this question, the proper location of a small-pox hospital, we may be guided by the experience of those communities where the violation of the natural laws governing the spread of infectious diseases has been productive of serious harm.

The principal information upon this point comes, not from Germany, since Germany has neither small-pox nor small-pox hospitals, but from England, where both are abundant, and instances of faulty locations are often reported.

Several years ago the small-pox hospitals of London were established in districts of the city which were becoming every year more and more populous and densely settled. In the midst of several moderate epidemics of small-pox which occurred between 1877 and 1881, it was observed that the prevalence of the disease appeared to bear a direct relation to the distance of certain infected localities from one of these hospitals (the Fulham Hospital). Similar observations were also made at Sheffield, Warrington, and Hastings in later epidemics. In consequence of these observations the old small-pox hospitals of London have been abandoned, and a new location has been established several miles down the river, where some hospital ships are moored in the river, to which all patients are now taken for treatment. And what is the result of this change? According to a statement in the London *Lancet* of Feb. 22, 1902, during the present epidemic of small-pox in London, and while these hospital ships have been crowded with patients, the disease has broken out at Purfleet, a village just north of the Thames and about a mile from the ships: —

Dr. Thresh,* the medical officer of health of Essex, attributes the excessive prevalence of small-pox at Purfleet to the proximity of these

* "Hospital Ships and the Dissemination of Small-pox," by Dr. J. C. Thresh, the *Lancet*, Feb. 22, 1902, p. 495.

hospitals of the Metropolitan Asylums Board of London. Cases have followed one another in rapid succession since September last, until about one-tenth of the population has been attacked, and it has spread to adjoining parishes.

Vaccination has been much neglected in Purfleet: "The prevailing wind has been from the south-west; and in the cottages nearest, and exposed to the prevailing wind, out of every eight persons, one has been attacked. If such an epidemic prevalence had occurred in London, there would have been over a half-million cases in the past seven months. My impression is that the infection may be carried two or possibly three miles in the direction of the wind."

In an editorial in the same issue of the *Lancet* the same view receives substantial support in the following words: "These revelations are extremely inconvenient," — that term "inconvenient" no doubt relates to the conclusions that had been already made, that had induced them to carry these ships down to that point — "and another result should be the recognition of the fact that *we cannot, by isolation, hope to get rid of small-pox.* The remedy is ready at hand, and consists in placing revaccination on the same basis as primary vaccination. With the German method we shall avoid small-pox outbreaks, but with primary vaccination alone we can never hope to do so."

Hence we find that the local government board of England has arrived at quite definite conclusions upon this subject. The following statement is quoted from their memorandum, or circular, of January, 1895: —

Small-pox hospitals have again and again served to disseminate that disease to neighboring communities, and this, to use the words of the Royal Commission, "in spite of precautions almost in excess of any that would have been anticipated" (L. G. B. Memorandum, 1895).

It is not certain, what distance they are dangerous to surrounding populations, but it may be accepted that it is *not safe* to erect a small-pox hospital: —

(1) On a site within ¼ mile of a hospital, either general or for infectious diseases, or of a workhouse or similar institution, or of any aggregation of 150 to 200 persons.

(2) On a site where it would have within ½ mile a population of 500 to 600, whether in one institution or in dwelling-houses.

These distances are not to be taken as absolutely fixed, and the case of a considerable population resident just outside such limit would call for serious consideration.*

*"Himes's Practical Guide to the Public Health Acts," p. 639. See also Copnall's "Infectious Diseases and Hospitals," p. 232.

The exceedingly contagious nature of small-pox is one of its peculiar characteristics. In this respect it surpasses all other diseases. Whooping-cough may be communicated from one person to another at a short interval of space, and so may scarlet fever and diphtheria, especially when the two parties, the sick and the well, are in a small closed apartment. With small-pox, however, the case is otherwise; and, according to the observations of Dr. Thresh, the infection may be carried two or possibly three miles in the direction of the wind.

I think this might be modified, perhaps, by other statements that have been made; that is, that large aggregations of cases, several cases in one house or one building, would constitute a greater danger to the community than a single case.

This peculiar tendency of the infection of small-pox to be transmitted through the air for considerable distances is illustrated in Dr. Powers's report of 1882, from which the following figures and conclusions are quoted: —

Admissions of Acute Small-pox to Fulham Hospital, and Incidence of Small-pox upon Houses in Several Divisions of the Special Area during Five Epidemic Periods.

Cases of Acute Small-pox admitted.	In Epidemic Periods since Opening of Hospital.	Incidence on Every Hundred Houses within the Special Area and its Divisions.				
		On Total Special Area.	On Small Circle 0–¼ Mile.	On First Ring ¼–½ Mile.	On Second Ring ½–¾ Mile.	On Third Ring ¾–1 Mile.
327 . .	Mar., 1877–end of 1877,	1.10	3.47	1.37	1.27	.36
714 . .	Jan., 1878–Sept., 1878 .	1.80	4.62	2.55	1.84	.67
679 . .	Sept., 1878–Oct., 1879 .	1.68	4.40	2.63	1.49	.64
292 . .	Oct., 1879–Dec., 1880 .	.58	1.85	1.06	.30	.28
515 . .	Dec., 1880–Apr., 1881 .	1.21	3.00	1.54	1.25	.61
2,527 . .	Five periods	6.37	17.35	9.20	6.16	2.57

Conclusions Relative to the Spread of Small-pox in the Neighborhood of Hospitals.

1. There has been in each epidemic period an excessive incidence of small-pox in houses in the neighborhood of the hospital as compared with more distant houses in Chelsea, Fulham, and Kensington.

2. The percentage of houses invaded in the neighborhood of the hospital has become gradually smaller as the distance of the houses from the hospital has increased.

This gradation has been very exact and very constant.

3. Houses upon the chief lines of human intercourse with the hospital have not suffered more than houses lying in other directions from the hospital.

4. In point of time there has been a very marked relation between the varying use of the hospital and the manifestations of excessive small-pox in the neighborhood.

This relation has not shown itself, while the use of the hospital has been for convalescents only.

5. The appearance of excessive small-pox in houses around the hospital has never been delayed until the hospital has become full, or nearly full. It has been always most remarkable at the time when admissions to the hospital were beginning to increase rapidly.

In the succeeding months of active operations, though the use of the hospital may have gone on increasing, the excess of small-pox upon the neighborhood has habitually become less marked.

6. On comparison of different epidemics an almost constant ratio is observed between the amount of the hospital operations and the degree of excess of small-pox in the neighborhood.

7. The machinery of the hospital administration, with inclusion of defects in that machinery, does not account for the peculiarity of small-pox incidence within the three parishes of Chelsea, Fulham, and Kensington since the establishment of the hospital.

8. There must have been some condition or conditions operating to produce the observed distribution of small-pox around the hospital that have pertained to the hospital as such, and that have been in excess of the condition of small-pox extension as usually recognized.

9. During the present epidemic period, and most probably during former similar periods, there has arisen in the atmospheric circumstances of the time peculiar facility for the dissemination in an undamaged state of any matter that may have been given off from the hospital.

A similar occurrence has recently taken place in the city of Everett on a smaller scale. Everett is a city of peculiar conditions. It has

had an exceptionally rapid growth, having increased its population more than tenfold in the past thirty years (population in 1870, 2,220; and in 1900, 24,336), while at the same time it is one of the smallest cities in point of area, having less than three square miles of territory.

Early in the present epidemic a case of small-pox was found in a house opposite a railway station and in a quite densely settled district. The case was quarantined at this house; and as soon as other cases occurred they were taken to this house for treatment, the house being made a temporary hospital. As a natural result, several other cases occurred within the next six months in the neighborhood of this house.

I have here Dr. Thresh's more recent statement, published in June in the *Medical Magazine*. There is hardly time to read any further conclusions from it, but I think what I have stated sufficiently covers the subject.

Dr. A. E. Miller.— I would like to ask Dr. Abbott the distance where there was $2\frac{1}{2}$ per cent. I did not get that.

Dr. Abbott.— One mile; that is, between the three-quarter mile and one mile, the outer ring of the circle.

Dr. Chase.— I would like to ask Dr. Abbott what the capacity of the small-pox hospital was. It makes a great difference, I understand.

Dr. Abbott.— The Fulham Hospital?

Dr. Chase.— Yes.

Dr. Abbott.— It must have been pretty large, I think. It probably held, I should judge, three or four hundred patients, though I don't know. But I know the new one down the river is already holding to-day, or held during the last two or three months, about thirteen or fourteen hundred at a time.

Dr. Chase.— The minimum distance, then, should be, did I understand, a quarter of a mile or a mile?

Dr. Abbott.— A quarter of a mile.

Dr. Chase.— Then, if the hospital is such as we ordinarily have in our towns for small-pox patients, one to accommodate, say, a dozen patients, a shorter distance than a quarter of a mile would suffice, would it not?

Dr. Abbott.— I should think it might. I think the general rule would be to put it as far away as you can.

Dr. Hill.— Mr. Chairman, as far as I am aware, the Massachusetts experience in the matter of carriage of small-pox to a distance hardly agrees with the English experience; and I should like very much to hear some of those who have had experience in Massachusetts with small-pox talk on that point. I think there are a number of other men that feel the same way.

Dr. Field.— I think that in Lowell the small-pox hospital must be between a quarter of a mile and half a mile from the poor-farm. I doubt if it is much over a quarter of a mile. I do not know of a case of small-pox ever arising in the poor-farm. They are both on the same land; and it is about five minutes' walk, four minutes' walk, from one to the other.

Dr. Magee.— I have had a little experience this year in small-pox. I had three cases of small-pox in a house on Oak Street. The area between the houses was about 4 feet, and we have had no contagion from that. I also had three cases on Cross Street, where the area was 15 feet on one side and 20 on the other: no contagion from that. We have had in the town of Andover some twelve cases, and the area between the houses there was somewhere about, I should judge, 150 feet: no contagion from that. But we had a little field surrounding the poor-house, and we have had small-pox from that. So far as contagion is concerned, I think it is something that is pretty hard to define. That has been my experience the last few years with small-pox. We have had no contagion outside from those houses, and the windows have been open at times no doubt; and neighbors have been within 15 feet on one side and 20 on the other, within four feet in one case. The windows not only had screens in, but I guess the screens were raised once in a while.

Dr. A. E. Miller.— Mr. President, I should like to ask the gentleman who relates this experience if one reason why they have not had contagion has not been because they have had thorough vaccination of the individuals around, and that vaccination prevented the contagion.

Dr. Magee.— In my cases I can't say that they have been vaccination, for I don't know.

Dr. A. E. Miller.— I should be inclined to think there had been thorough vaccination.

The President.— Dr. Swarts, haven't you some Rhode Island experiences that might be interesting?

Dr. Swarts.— Well, as to the location of hospitals in connection with the spread of the disease, I think most of us in Rhode Island do not have that fear of the spread from isolation spoken of; that is, if the isolation is what it should be, there should not be any spread. One instance occurred where I was called upon to decide whether a patient should be removed from a house which was 20 feet distant from a school of about 200 children, and the question was whether the school should be closed or not. I told them to continue the school. I thought they were safer within bounds than without. Of course, the equations of every individual case and of every hospital must be taken into consideration. If your isolation is absolute, you may have 1 or 50 patients; and if the possibilities of spreading the disease are good, as undoubtedly they may be in the London hospitals, where they have so many cases, and where the neighborhood possibly is a negligent one, I should think the spread might be considerable. I think that it is a question of all conditions present which you must take into consideration, not simply the area, the location of the hospital, and having any number of cases surrounding it, but who the people are who have the cases in charge, the methods of isolation, the care which is taken of the patients to prevent desquamation from being carried through windows or by the attendants. I think so many factors come into the question that I personally, and I think most of the officers in Rhode Island, would have very little fear to locate a hospital within the inhabited area of the city, the only objection being public prejudice; that is, we feel that, if we have a hospital, it should be under proper control and proper conditions, and that the spread of the disease will depend, not upon the location of the house, but the care of the individual.

Dr. Palmer.— Mr. Chairman, I am one of the victims of popular prejudice in the care of small-pox; and I think there is a great deal yet to be learned about its contagiousness. If I relate the expe-

rience in Framingham, it may possibly be instructive. There were two cases during the past winter. One was in a private house, isolated there; and there was no further trouble from it. The second case came down in a hotel; and the man went to the dining-room, and to the dining-room table, after he was thoroughly broken out. He was isolated, as Dr. Abbott says, the best that could be done,—and this was the cause of my undoing,—in a private house, at least 150 feet away from any other one; and there was no other case from it. The only point that I want to make is that I think we don't know absolutely yet where small-pox comes from or how far it may be carried. We know only in a measure. If any people were exposed in the second case to which I referred, it was the people round and about that hotel from which the case was taken.

Dr. Otis H. Marion.— How many were vaccinated?

Dr. Palmer.— The precaution was take to revaccinate those who were exposed in the hotel; and the hotel was quarantined, and no one allowed to go in or out until we thought they were safe.

Dr. Hill.— Mr. Chairman, since no one else will ask the question, I shall have to ask Dr. Shea about the Northampton Street hospital.

The President.— Dr. Shea, we shall be glad to hear your experience.

Dr. Shea.— Mr. President, before we establish a hospital for small-pox, we always see that the neighborhood is well vaccinated; and, as a result, we have no cases near our hospital. That has been our experience. At the beginning of this last epidemic we sent a squad of physicians, and we vaccinated the neighborhood for a mile each side of the hospital; and the district shows that we have not had many cases round the hospital there. I think it would be prudent for any town or city, before it establishes a small-pox hospital, to see that in the immediate neighborhood, within a radius probably of a quarter of a mile, all the families were well vaccinated.

Dr. Abbott.— Mr. Chairman, I should like to add one or two words upon this. These cases are mostly, you might say, negative evidence of isolated cases, perhaps, that have been brought up; but these conclusions of the Fulham Hospital were made from 2,527 ad-

missions in one building, and the aggregation of that number of course adds to the value of the conclusions. In regard to this particular point of vaccination, Dr. Thresh's more recent article brings up this very point, because the London anti-vaccinationist is a pretty busy person, and picks up every point in the argument that he possibly can against vaccination. He says:—

It has been urged that the fact that no cases have occurred amongst the garrison at West Purfleet [that is, a government institution] or amongst the lads on board the training ship, "Cornwall," [near by this, at West Purfleet, a little distance from that village], both within three-quarters of a mile radius of the ships, prove that the infection is not air-borne. Certainly, at first sight, it does appear singular that these should have escaped. But the reason is very simple. The barracks lie to the extreme north of Purfleet, in the portion where only two cases of small-pox have occurred; but the immunity of the garrison is due not so much to the position of the barracks as to the fact that every inmate has been *revaccinated*, save a few who had had small-pox previous to the present outbreak.

So this vaccination of the people in the surrounding neighborhood is a pretty important one, after all.

Dr. Palmer.— Mr. Chairman, if I may be allowed, I should like to ask a question. If it is out of order in this discussion, you will rule it out. I should like to ask the opinion of those present as to the temperature that will affect the activity of vaccine virus. That question has been brought to my mind recently. I find a great many physicians keep their vaccine, very conveniently, right on their desk beside them, to use when it is necessary, while I have been told by the agents of the mercantile houses that it is necessary that it be kept constantly in a cool place. If any one can give light on that, I should like to have it.

The President.— Dr. Smith, cannot you help us to an answer?

Dr. Smith.— Mr. President, vaccine virus maintains its efficiency at a variety of temperatures. The best temperature is that of the ice-chest, about 55 degrees Fahrenheit; but it will remain efficient at a higher temperature, provided it is in the form of glycerinized lymph. If it is dried on the end of points, the more rapidly will the vaccine

organisms be destroyed. It depends largely upon the manner in which the virus is put up for use. I should like to ask whether the question was asked concerning the dried virus or the virus that is mixed with glycerine.

Dr. Palmer.— What I refer to is the tubes of the glycerinized lymph.

Dr. Smith.— It seems to me that the ice-chest temperature would be the better temperature. Within the period within which virus is usually used I think the ordinary temperature probably would not destroy it, though it might destroy it a trifle faster than a lower temperature.

The President.— If there is nothing more to be said upon this subject, we will proceed to the consideration of the third question : —

Should boards of health require the reporting of cases of chicken-pox ?

Perhaps you can say something about that, Dr. Chase.

Dr. Chase.— I don't know exactly why I should be called upon to speak upon that subject. We have authorities here on small-pox, and I don't pose as one. But I know how closely chicken-pox simulates small-pox ; and I am called on frequently to settle the diagnosis, and a difficult one. I will admit that I was the one that asked that question, but not the one that proposes to answer it. In some places, chicken-pox is obliged to be reported because of its frequent simulation of small-pox. In the town in which I live our board does not require the reporting of cases of chicken-pox ; and I am here to learn, if I can, what we ought to do, require it or not require it.

Dr. Magee.— Mr. Chairman, I may have something interesting to say on that subject. Two months ago or more in my city there was reported a case of chicken-pox by one of our physicians, who is quite a bright man ; and the agent of the board of health went to see it. He doubted the diagnosis of the physician. He came to me about it. I told him that something should be done. He doubted the diagnosis. The physician objected to any local doctor going in to see the case. Finally, we sent for our friend Dr. Morse ; and, after the man had supposed chicken-pox for two weeks, it turned out to be a case of small-pox. We have had similar cases of that kind. I

think myself that it is the duty of physicians and boards of health to insist on the report of so-called cases of chicken-pox or all cases of eruptive disease, especially at a time when small-pox is quite prevalent. There are a great number of physicians who have not seen cases of small-pox. In the town of Andover, I have had twelve cases of small-pox; and Dr. Morse can bear me out in my statement. A gentleman contracted small-pox in the city of Boston, or we think he contracted it there. His was a very light case. He attended to his business, with the exception of two or three days. He had a headache and a backache and chills and a little vomiting, and the doctor who was attending him thought he had chicken-pox. He went along; and his wife contracted chicken-pox, so called. His four children, from the ages of two to seven or eight, contracted chicken-pox, so called. But they were all cases of small-pox,— six in that family. His book-keeper contracted small-pox, his brother-in-law and his sister-in-law contracted small-pox; and they were all reported chicken-pox.

A Member.— And his father-in-law.

Dr. Magee.— And his father-in-law, yes.

A Member.— The mother-in-law escaped.

Dr. Magee.— But I had those cases. This was in a town where the board of health, to say the least, is not very particular. This went along, and we have had twelve cases of small-pox in the town of Andover, and were very fortunate to get rid of it with only twelve cases. We have had one death. I have given you the source of contagion. I think myself, if that case had been reported in proper time, probably eight out of the twelve would have been vaccinated in proper time, and would not have had small-pox. I certainly think it is important to report cases of chicken-pox to the boards of health; and they should send a physician immediately or call on the proper authorities to go and examine those cases, especially where chicken-pox is reported in an adult. Many people believe that you cannot get chicken-pox in an adult; but there are cases of chicken-pox in the adult, there is no doubt of that. When you get chicken-pox in persons of — well, above eight years of age, I certainly think they ought to be reported, if not under; but my idea is that all such cases should be reported.

Dr. Durgin.— From the experience we have had in the city of Boston in the last thirty years it is safe to say that you are much better off in calling for the report of cases of chicken-pox, and looking them up. If you don't, you will occasionally have some undiscovered cases of small-pox spreading the disease.

Dr. Magee.— Our board of health in the city of Lawrence insists on the reporting of chicken-pox cases.

Dr. Durgin.—We have called for the report of cases of chicken-pox in Boston for quite a good many years. We look them up, and find some cases of small-pox among them.

Dr. Magee.— In the children there?

Dr. Durgin.—Both children and adults. I am glad the preceding speaker has mentioned the fact that it is not safe to conclude that you don't get chicken-pox among the adults.

The President.— Are you satisfied, Dr. Chase?

Dr. Chase.— Perfectly satisfied. Thank you, doctor.

The President.— The next question is, Should boards of health make provision for the care and isolation in hospitals, when so requested, of patients ill with measles?

I have to ask for some volunteer upon that matter. I don't know who is an authority upon the subject.

Dr. Chase.— Mr. Chairman, as Dr. Currier, the acting superintendent of the south department of the Boston City Hospital, is present, perhaps he will tell us a little about the experience there.

The President.— We shall be glad to hear from Dr. Currier on the subject.

Dr. Currier.— It seems very important to me that measles should be isolated at the very first sign of any symptom. The cough especially, and the coryza, and the koplik spots inside the cheeks have been proved to be preliminary symptoms. Every case is followed by

the measles eruption. The measles eruption with these symptoms, if not isolated, will certainly cause an epidemic in any hospital or elsewhere, whether the exposure is direct or indirect.

Dr. Chase.— Mr. President, I should like to know what the practice is in Worcester about admitting measles patients to the contagious hospital.

Mr. Coffey.— Mr. Chairman, there is no provision made in Worcester for caring for cases of measles in the isolation hospital there, although we have felt a great many times since we have erected the hospital that we ought to have made provision for it. At the outset, while we considered it, the extra expense involved made us fearful that, if we asked for the amount necessary to care for measles with diphtheria and scarlet fever, we might not get anything, so that we did not ask to include measles in the amount asked for. Since we have been operating our hospital, now about six years, we have in a great many instances felt the need of accommodations for cases of measles. There has been a number of times persons taken sick at hospitals and boarding-houses and at some of the schools. There are a large number of preparatory schools in Worcester, from which we get quite a number of patients with diphtheria and scarlet fever. We have also had applications to care for measles, but have been obliged to refuse because no provision was made for the care of measles. But we have asked for an appropriation to make an addition to our hospital there; and it is our intention, if we obtain that appropriation, to make provision for the care of a number of cases of measles,— perhaps not to attempt to take care of them in any general way, but those isolated cases that arise,— servants in private families, patients in hotels, boarding-houses, and at those schools that I speak of. In every community there must be a large number, of course, varying with the size of the community, of cases of that kind, where it is extremely difficult, if not impossible, to properly treat and isolate a case of measles without putting the family to a great deal of inconvenience; and I think that, when the communities, as they are now doing throughout the State, make provision for the care and treatment of contagious disease, some arrangement ought to be made to treat measles, those isolated cases that I speak of. I know that in a large community it would be very difficult, perhaps,

to build a hospital large enough to care for measles when it becomes epidemic in the thickly settled section; but, as I said, some provision ought to be made, in my judgment, for those cases that occur, as they frequently do, in houses and institutions and hotels, where it is almost impossible to properly treat and care for them.

Dr. Perry.— Mr. Chairman, there is one other point along that line which has not been touched upon; namely, the cases of measles which are complicated with pneumonia. Among the very poor these cases not infrequently occur, and, I venture to say, vex the physician and tax his powers more than almost any cases he is called to attend. Then, again, an empyæma demanding surgical interference may be a sequel of a pneumonia starting from measles. Still, if the patient has measles, in many cities he cannot be taken to a hospital; and, if the patient is very poor,— for instance, a city physician's patient,— you can see that the nursing and the general care of the patient would be very inadequate, perhaps, with our present lack of special arrangements, for the treatment of such patients. Since measles complicated with pneumonia must be attended to as cases of measles, it would seem that especial provision in our contagious hospitals should be made at least for such cases as have a coexisting pneumonia or require surgical attention.

Dr. Field.— What has been said seems to show that boards of health popularly consider measles a milder disease than scarlet fever or diphtheria, and I imagine that Dr. Abbott would tell us that in some epidemics that is far from being the truth. I remember that in Lowell fourteen or fifteen years ago we had an epidemic of measles, in which more persons died than died from scarlet fever and diphtheria together for several years. We lost 108 people, I think, from measles, when Lowell was a much smaller town than it is now.

Dr. Magee.— Wasn't it complicated with something, doctor?

Dr. Field. — I presume there were complications, as there very often are with measles; but it was measles.

Dr. Magee.— Do you remember that epidemic, doctor, at all?

Dr. Abbott.— No.

Dr. Magee.— It is very rare that you lose a case of measles without some complication.

Dr. Abbott.— The fatality is inside of 4 or 5 per cent. usually.

The PRESIDENT.— Is there anything more to be said upon this subject? If not, there is one other question that has been submitted; and that is,—

Is it advisable that any municipality of 50,000 or more population shall discontinue its bacteriological laboratory, and depend again upon such assistance as the State Board of Health can render it?

I should like to say, before asking general discussion upon the subject, that, so far as the State Board of Health goes, our resources are taxed to the utmost; and it is not possible to do any more with the present appropriations or with the present room than is already done. No one is better aware than myself that what the State Board does is a very insufficient protection for the Commonwealth in this direction. It does seem to me that there is absolutely no question that a municipality of 50,000 people ought to provide a bacteriological laboratory of its own. There are so many questions that modern civilization demands of such a laboratory that every municipality fifty or forty or thirty miles, even, away from Boston, should be in condition, when called upon, to answer them.

DR. MAGEE.— Is there any law pertaining to that?

THE PRESIDENT.— No. Perhaps Dr. Davenport has given some consideration to such a question as that. He is a scientific man with a laboratory.

DR. DAVENPORT.— Mr. Chairman, I have not had much experience in that regard. My municipality was only of 10 to 11,000; and, as I said in my previous remarks, I am no longer chairman or even a member of the board of health, for the reason of alleged undue activity. [Laughter.] The institution of a bacteriological laboratory in charge of one of the school inspectors was one of the forms of activity which was displayed. Curiously enough, my fellow-practitioners did not support me in the manner I had anticipated. Some of them even privately told me I was interfering with private professional business in carrying out the school inspection in the thorough manner I was having it done.

The President.— Dr. Spencer, you have had charge of a bacteriological laboratory in Cambridge. Cannot you tell us something upon this subject?

Dr. Spencer.— Mr. President, we could not dispense with it, —could not dispense with it, never should consider it for a moment.

Mr. Coffey.— I want to say that in Worcester we have had a bacteriological laboratory for seven or eight years. I think we were the first east of New York to establish one; and we certainly would not think of dispensing with ours, because very frequently we are able to get a diagnosis from our bacteriologist within five or six hours after the culture comes in. That would be impossible if we were obliged to send it to Boston, to the State Board of Health. We have cultures brought in sometimes in the forenoon; and at three or four o'clock in the afternoon the bacteriologist is able to make a diagnosis, and does frequently, and the patient is removed to the hospital within five or six hours after the case is first reported. That, of course, would be impossible if we were obliged to send the culture to Boston. It is such an advantage that we would not want to dispense with our laboratory.

Dr. Magee.— We have none in our city.

Dr. Palmer.— It might be of interest, Mr. Chairman, if I were to state that in connection with the little cottage hospital in Framingham, we are doing something of that work ourselves.

The President.— Your population is how much, doctor?

Dr. Palmer.— Only 11,000.

Dr. Perry.— Mr. Chairman, there is a municipality of even 65,000 inhabitants that has had a bacteriological laboratory established — this is now the third year. I have just received intimation that the discontinuance of that laboratory was being considered. It was established by the local board of health late in 1900, in compliance with a demand registered in the unanimous vote of the local medical society. It seems to me most inexpedient that a department which despite its niggardly appropriations has been so efficient and successful from its very beginning, as a recent statement signed by sixty-nine physicians who have used the laboratory and now demand

its continuance vouches that department to have been, should now be discontinued on account of an expense of a few hundred dollars a year. Thus to imperil the lives of thousands of the residents of that municipality seems to me an outrage against sanitary progress little less than criminal. Far from any discontinuing or crippling of this department, it would seem that the confidence which the laboratory has already won among the medical men of that municipality warrants an increased appropriation commensurate with its present necessities and its constantly growing importance and usefulness.

I should like to hear from our State Inspector upon this subject.

The President.— Dr. Morse, we shall be glad to hear what you have got to say.

Dr. Morse.— Mr. President, that is something that I have not given very much attention to; but I think it would be a serious reflection upon the city of Somerville to withdraw its bacteriological laboratory. I think more could be done with it if the board of health would make certain regulations which they do not now require, insisting upon patients ill with diphtheria having two negative reports from their throats before releasing them from quarantine. It seems to me that the bacteriological laboratory at Somerville should be equal in efficiency to any other in the State.

Dr. Abbott.— Mr. Chairman, this opens up quite an important phase of this question, which in a general way is, I think, one that may be made useful by large cities to the surrounding neighborhood. I refer particularly to the city of Springfield, which maintains a bacteriological laboratory in which work is done for quite a large territory, extending, perhaps, thirty or forty miles in any direction from Springfield, even over into Connecticut, I believe; but that is, perhaps, outside the question. It is a very convenient thing for that neighborhood to have one so located that material can be sent there from those towns and a reply can be had very soon, compared with the time which would be consumed in getting material down to Boston and getting the reply back again.

Dr. Lowell.— Mr. Chairman, as the bacteriologist of the city of Somerville, I should like to state how things have worked there. For the year 1900, that was the year before the laboratory was established,

the work was practically all done by the State Board of Health laboratory. To be exact, the laboratory was established late in the year 1900. During that year there were 520 cases of diphtheria reported. During that year the State Board of Health laboratory examined 322 cultures for diphtheria. During the year 1901, the first part of the year, the city physician, Dr. Perry, examined the cultures (for three months). I was appointed in April, and examined them for the rest of the year, and am examining them now. In the year 1901 there were 340 cases of diphtheria reported, and there were 801 cultures examined. For the year 1902, for the first six months or up to date, there have been some 96 cases of diphtheria reported. Up to the first of July I have examined 500 cultures for diphtheria. That is about four cultures and a half or five cultures for each case of diphtheria reported. There have been 96 cases reported; and I have had over 90 of those come through the laboratory for examination, for diagnosis, or for release or negative for release. I think those figures alone show pretty conclusively to what extent the physicians of Somerville have appreciated a local laboratory.

Dr. Durgin.— I want to apologize for forgetting one question which was sent to me instead of to Dr. Walcott. It was from Dr. Fiske, of Fitchburg, and was concerning the collection of the expenses for caring for patients with infectious diseases.

Dr. Fiske.— I included all other contagious diseases, any case of quarantine. In cases of quarantine for contagious disease, whether cities and towns where the cases occurred supported the families during quarantine, and, if so, to what extent, and what proportion of the families ever paid back a rebate to the city or town for the quarantine as under the Public Statutes?

Dr. Durgin.— We don't quarantine families for small-pox in Boston. We take the patient to the hospital, clean up the house and what is left in it, vaccinate all exposed persons and watch them for two weeks. Cases which go to the hospital, if their legal settlement is in the city, we take care of, and say nothing about it. If their legal settlement is in any town within the Commonwealth, that town must by law pay the reasonable expense of taking care of the patient. If they have no legal settlement in any place within the State, then the State itself pays the bill for reasonable expenses.

Dr. Fiske.— Mr. Chairman, in towns or cities that have not an isolation hospital for scarlet fever or diphtheria, for instance, I presume the families are quarantined with the case; and in that case there would not be any expense to that city or town during the quarantine.

Dr. Durgin.— In Boston we pursue this course with regard to scarlet fever and diphtheria. A case is reported. The house is visited at once by an officer of the board of health, to see if isolation is satisfactory. If it is, the patient is isolated there by order of the board of health. A card is at once put up, indicating that the board has assigned those quarters for the isolation of that case. No bills are incurred by the board of health. The patient is left under the care of the attending physician and the family. If, however, that case is not isolated to the satisfaction of the board of health, it is at once removed to the hospital. As to paying the bills there, I am not certain whether any of the expense is collected from the patient or from the State.

The President.— Perhaps Mr. Coffey can answer those questions.

Mr. Bodwell.— Mr. Chairman, if you will allow me, I hope there will be a general expression on this question. I am speaking for myself and of small-pox. In Salem, when we have a case of small-pox, we take the patient to the hospital. We have this winter quarantined the house afterwards, and it has been very expensive. For instance, within two weeks we have had a house quarantined where there are eighty in the house, of course we paying all expenses; and that is very expensive. I thought I should like to have an idea of how many places were doing that sort of business.

Mr. Coffey.— At the meeting in Boston — either the last meeting or the annual meeting, I have forgotten which now — this matter was discussed under the head of small-pox; and I stated then that at Worcester, since 1894, we have not quarantined any house in small-pox. We do as they do in Boston. The patient is removed to the small-pox hospital; and immediately our inspectors go in and disinfect the house, and everybody in the house that has been exposed is vaccinated. A visit is made every day to that house for two weeks, to

ascertain if any person who was exposed is ailing. Otherwise, we don't in any way interfere with the family. We have had two or three outbreaks of small-pox since 1894. That year was the first year we began to do that. We had some 20 cases that year, and we did that all through that epidemic. We had no trouble in suppressing it. And we have not had any trouble in suppressing the disease through these other outbreaks that we have had. We have had no spread from the place of outbreak to other places, have had no difficulty whatever. There is no expense attached to it; and, consequently, there are no bills to be paid. Now, in diphtheria and scarlet fever, we don't force anybody to go to the isolation hospital. The hospital, to begin with, is too small to accommodate all of them. We have gone on the theory that we would allow people to voluntarily decide whether they should send their children to the hospital or not, and that has worked very satisfactorily. We don't quarantine. A card is put on the house, "Scarlet Fever" or "Diphtheria." The schools are notified, and the libraries and some of the public institutions are notified of every case. In certain trades and occupations we refuse to allow the members of the family to go to their work. For instance, men engaged in the grocery and provision trade, who are handling food, or who are driving the delivery wagons of grocers and butchers, and visiting houses,— those people we do not allow to pursue their usual avocations. They must either send the child to the hospital or must cease work. Sales-girls in dry-goods stores, girls who work in the large corset factories, who are handling goods that might act as fomites to spread the disease,— in those cases we say to the people: "This child must go to the hospital, or you must cease work. You can take your choice." In most cases they allow the child to go to the hospital. We don't consider that we are responsible in any way for the loss of that person's services, and no bills have ever been rendered to us; and consequently we have never paid any bills for that.

Now I would like to ask a question; and I think the doctor, perhaps, had it in mind. A new law has been passed recently, which is a change from the law that has been in force for a great many years in relation to the payment of settlement cases. Under the old law those bills were paid, without any question, by the overseers of the poor. The bills were rendered to the overseers of the poor. Under

the new law, when a case of contagious disease is taken charge of by any city or town, and expense entailed, the board of health of the city or town in which that case may have a settlement is notified. Until within a year that notice was always sent to the overseers of the poor. This new law makes a change, and necessitates the sending of the notice to the board of health, who are obliged, under the law, to turn it over to the overseers of the poor to ascertain settlement. If the settlement is in the city or town to which the notice is sent, then they acknowledge the settlement. The question that I would like to have answered is this: Has any city or town that is represented here to-day by its city solicitor or by any case in court determined whether that settlement money is to be paid by the board of health, or, as in the past, by the overseers of the poor? This case has come up in Worcester, because the overseers of the poor have notified me that these notices that we have received from other cities and towns, that they were caring for persons who have a settlement in Worcester, must be paid from the appropriation of the board of health. As a matter of fact, the board of health has no appropriation for any such purpose. This law went into effect, I think, this year, on March 26, and consequently we have no appropriatron for that purpose; and yet the overseers of the poor have notified us that under the law we shall be obliged to settle any claims that are made upon us by any other city or town of the Commonwealth.

Dr. Magee.— Contagious diseases?

Mr. Coffey.— For any contagious disease which is treated by that city or town. Any expense incurred in the treatment of cases of contagious disease by any city or town is now required, as I said, to be reported to the board of health of the town instead of, as formerly, to the overseers of the poor; and the overseers in Worcester contend that the payment must be made from the appropriation for the board of health. You know this is a new law that was passed, I think, by this last legislature, which changes the law which pauperized persons afflicted with contagious disease. The old law included them in the general pauperization of persons who are aided: the new law exempts those persons who are treated for contagious disease, and says they shall not be pauperized; and, con-

sequently, the overseers of the poor have refused to pay. They say that under the general laws, and under some decisions that have been given, no money can be expended by the overseers of the poor that is not expended for the benefit of paupers, and that this new law exempts these people from being paupers, consequently that they cannot spend their money for that purpose. The fact is that the laws require that the notice shall be sent to the board of health instead of, as formerly, as I said before, to the overseers of the poor. What I wanted to know was, Has any city or town had it settled or determined by any opinion from a lawyer of standing, or by the courts, or even by the State Board of Lunacy and Charity, whether that money is to be paid from the appropriation of boards of health, or, as formerly, from the appropriation of the overseers of the poor.

Dr. Fiske.— Mr. Chairman, Mr. Coffey has touched on a vital point of my question. It was on account of this new law that I put the question, because the board of health of the city of Fitchburg has had that very trouble. We had a case of diphtheria occurring in a neighboring town, in a poor family who had a settlement in our city; and, after the case was entirely recovered, the bill was sent to our overseers of the poor. They repudiated the bill, sent it back to the town where the case occurred, and then various correspondence occurred between the town and city. It finally came into our office, and we declined to pay the bill; and it went back again to the town. But, in looking the matter up, we found that under the new law the board of health had the jurisdiction in the matter rather than the overseers of the poor. We had no appropriation to pay that expense, and our board of health referred it to our mayor. That bill was put in simply as a bill or claim from that town against our city; and that bill as a claim bill went through our city government, was referred to the Committee on Claims, was acted upon, and our city government voted to pay it out of the incidentals on the approval of our board. It was not paid out of the appropriation of our board. But I should like to know how we should act in the next instance.

The President.— I am afraid this discussion will have to be continued, as it is time for the boat.

Adjourned.

JOURNAL OF THE

Massachusetts Association of Boards of Health.

ORGANIZED 1890.

[The Association as a body is not responsible for statements or opinions of any of its members.]

Vol. XII. January, 1903. No. 4.

OCTOBER QUARTERLY MEETING

OF THE

Massachusetts Association of Boards of Health.

The quarterly meeting of the Massachusetts Association of Boards of Health was held in Brookline on Thursday, October 30, upon invitation of the local Board of Health. Assembling at the Town Hall, Washington Street, at 10.30 A.M., members were greeted by Brookline officials, and under their guidance visited the board of health laboratory and the new contagious hospital. This hospital has two one-story pavilions, separated by an administration building, one of the pavilions being for the treatment of scarlet fever and the other for the treatment of diphtheria. At 1 P.M. the members reached the Public Baths, where they were given an exhibition of swimming, and where dinner was served and the business meeting held.

Dr. H. P. Walcott, President, presided at the business meeting. He opened it by saying,—

Gentlemen, I have the pleasure of presenting to you the chairman of the Board of Health of Brookline.

Speech of Welcome by James M. Codman, Jr., Esq.

Mr. President and Gentlemen,— It is a great pleasure to welcome to Brookline so many guests, so many public officers, and especially so

many medical men. Our Brookline Board of Health is not a board of medical men. There is not and has not for many years been a physician in our number; but we rely, of course, very much upon the advice of professional medical men. We like to keep in touch with the medical profession and to know what the doctors are thinking about and talking about, and we enjoy having you here and listening to you. Now quite a varied programme still awaits you, and it would not be appropriate for me to detain you from it any longer. [Applause.]

The records of the July meeting were read and approved.

The following ladies and gentlemen were nominated by the Executive Committee for membership in the Association: —

W. W. McKibben, M.D., of Worcester.
Humphrey C. Moynihan, of Southbridge.
Willard E. Ward, of Brookline.
Mrs. Ellen H. Richards, Massachusetts Institute of Technology, Boston.
May S. Holmes, M.D., Superintendent and Resident Physician of the Isolation Hospital, Worcester.
Agnes C. Vietor, M.D., New England Hospital for Women and Children Boston.

The President.— I hope the Association notice the fact that the Executive Committee present to you the names of three ladies for membership in this body, and they probably also notice the fact that that list is headed with the name of a lady who has given years of most enthusiastic and most intelligent service to the cause of public health. It is a most auspicious name to begin the new membership of the Association with.

The ladies and gentlemen named were elected to membership.

Dr. Durgin.— I want to give notice that at the next meeting of the Association there will be a request for a vote to increase the annual dues from $1.50 to $2.00. This becomes necessary in order to give moderate aid in the publishing of the *Journal.*

The President.— Dr. Durgin's motion, under your by-laws, is referred for action to the next meeting of the Association.

The first business for the afternoon is the conclusion of the dis-

cussion on the report of the Committee on Diphtheria Bacilli in Well Persons. The Association will be very glad indeed to hear from Mr. Aldrich, the superintendent of schools of Brookline, on that subject.

SANITATION IN THE SCHOOLS.

Mr. Aldrich.—*Mr. Chairman and Gentlemen*,—It is in response to Dr. Chase's invitation that I venture to take a moment of your time. Otherwise, I should feel that I was not justified in intruding. Dr. Chase has been good enough to print for use in the schools in Brookline the special report prepared by the committee of which Dr. Chapin was chairman. It relates to the general matter of inducing habits of cleanliness among school children. Our local Board of Health has prepared a placard of *that* size, and one has been posted in each school-room, near the teacher's desk; and then a copy of a leaflet has been put into the hands of every teacher, with the request at the end that "all teachers carefully read and preserve the above report, and carry out as far as possible its excellent suggestions." I presume I am right in thinking that Brookline is the first place to avail itself of the report of your Special Committee, and to make an active effort through the agency of the schools to put in operation its teachings.

If I am justified in saying one other word, I should like to take this occasion to acknowledge the great indebtedness of the whole school department of Brookline, first and foremost the children, then the teachers and the school officials, to our local Board of Health. It would take many words fairly to express the many good offices that they have done for us. Perhaps nobody better than a working superintendent of schools realizes how great the task is before us. The traditions of one sort and another are so strongly intrenched that nothing short of heroic warfare serves to overcome them. Within two years I had occasion to discuss with the city government in Springfield — a typical, wide-awake, progressive New England city — the placing of some baths in a school building. There never had been baths in a school building in that city, and with many of the city fathers that seemed to be a sufficient reason why there never

should be any. It was only when I was able to call to their attention sundry young children who told me that their clothing had been sewn on for the winter and they could not be expected to take a bath [laughter],— which is the literal truth, gentlemen,— only when I was able to adduce such a circumstance, that I was able really to convert that city government to the necessity of having school baths incorporated in the building. I think it is a distinct step in the development of that city to have secured that one move in the matter of baths.

As further evidence of the great work to be done, I want to call to your attention the benighted policy which we have pursued in the general care of our sanitaries, our out-buildings. I believe I was nearly or quite the first working school man to see that all retiring-rooms, toilet-rooms, in connection with school buildings were provided with toilet paper ; in a word, to make certain that children at school were provided with the same conveniences — necessities is the word, I think, rather — that they would find in a well-regulated home. As some of us look back to our own boyhood, and recall a kind of a shanty that stood out in the rear of the building, to which we used to resort at all stages of the weather and temperature, and then ask ourselves what we were expected to do when we were there, we must be impressed with the idea, I think, that we have been curiously oblivious of the demands of children. I don't know how we can expect to have decency and cleanliness and all the desirable qualities manifested on the part of children unless we make it possible for them.

Furthermore, one who is actively interested in schools gets some curious light on some phases of child life. In the school we don't often come face to face with the genuine child. We have there a sort of an artificial product, made up with more or less conscious purpose on the part of the pupil to conform to the wishes and expectations of older people. I found on the seashore this summer a very interesting bit of testimony that had been kicking around for a year, written by a little girl eight years old. On one side of the sheet, under the date of July 21,— this was a year ago,— she had indicated her pleasures : on the other side of the sheet she had indicated her troubles. There was the testimony of a genuine child. I will not

weary you with reading the entire list, but there is one that is significant; and I perhaps will read one or two others, because they are a little funny and will do for after dinner. This little miss, in enumerating her pleasures, had said, "Had chicken and mash potato at dinner." But the one thing among her pleasures which I think we are justified in noticing in this connection is this. Next to the last in the list comes this statement: "Didn't have my bath to-day." In the mind of an eight-year-old that was a distinct pleasure. Bathing is a cultivated taste; and I am inclined to think that there is no more important office for school men, and members of boards of health as well, than to induce in people a genuine love for cold water. I am inclined to think that, take the American people by and large, we could get on with less arithmetic, for instance, while we need more cold water and more music. When it comes to the little girl's troubles, there are also some things which are amusing. If there were time, I should be glad to read them. To show you the honest and ingenuous and transparent quality of the utterance, perhaps I may take the last two among her troubles: "Aunt Edith is as doleful as two rats"; and then, finally, "Wish my arms would get fat." There is a genuine child, expressing herself in all honesty, not at all expressing views which will be acceptable to some older person.

Renewing, then, the statement that no week goes by when we are not indebted to the good offices of the Board of Health, and especially to their very efficient agent, Dr. Chase, I will not trespass further on your attention.

The President.— Have the members of the committee present anything which they wish to say further upon this matter? Has Dr. Chapin or Dr. Hill anything to say?

The next business, then, is the paper upon the sanitary inspection of tenements, by Dr. Chapin, of Providence, R.I.

SANITARY INSPECTION.

BY DR. CHARLES V. CHAPIN, OF PROVIDENCE, R.I.

Mr. Chairman and Gentlemen,— Owing to a slight error, the title of what I have to say was noted in the programme as "The Sanitary Inspection of Tenements," whereas it is simply "Sanitary Inspection." I know very little about the tenement-house problem as it is understood in the great cities; and what few ideas I do have on that subject differ quite a little from those I have on the subject of general routine sanitary inspection.

I presume you are all familiar with Professor Sedgwick's most excellent treatise on the Principles of Sanitary Science,— if not, you ought to be,— and will accept his definition of hygiene as "the whole science and art of the conservation and promotion of health." Sanitary science, he says, "is that body of hygienic knowledge which, having been sufficiently and critically examined, has been found, so far as tested, to be invariably true."

Sanitary art is the method and process by which these principles are applied.

According to these definitions, sanitary inspection can only find justification, as a prominent phase of public health work, by clearly and in a marked degree preventing disease. Sanitary inspection, and subsequent executive action based upon it, interfere decidedly with the liberty of the individual. Sanitary inspection, and the abatement of nuisances which it is intended to accomplish, form a large part of the work of health officers. A sharp distinction must be drawn between sanitary and medical inspection: the former deals with nuisances, the later with infectious diseases; and there is very little connection between the two. As a rule, as much, if not more, time, money, and inspectors are devoted to sanitary than to medical inspection. In the mind of the public the chief function of the board of health is to abate nuisances. As a general thing, only one class of nuisances are considered by the health officer, those caused by the decay of organic matter. The board of health was originally authorized to deal with this kind of nuisance, because it was believed to be a fertile cause of sickness. When the filth theory of disease originated, I do not know; but in 1797 it was

potent enough to influence the General Court of Massachusetts to enact that the board of health shall "remove all filth of any kind whatever . . . whenever such filth shall, in their judgment, endanger the lives or health of the inhabitants." This act was a consequence of the typhus fever outbreaks of the time, and reflected the views of many as to the filth origin of that disease. In the revision of 1836 the law took its present form, which requires that the "board or the health officer shall order the owner or occupant, at his own expense, to remove any nuisance, source of filth, or cause of sickness." It has been copied by over a dozen other States, and is the model of most American nuisance legislation. The war against filth was not, however, waged very vigorously, except perhaps during epidemics, until the middle of the nineteenth century. The vogue of the filth theory was due largely to the labors of Edwin Chadwick, an English attorney, who, drawing the most unwarranted conclusions from observed facts, vehemently urged that the infectious diseases were due to decay, and that by municipal cleanliness they could be stamped out and the general health of the people vastly improved After 1850 these views rapidly gained adherents in this country, and for forty years the word of the sanitary inspector was supreme in affairs of public health.

But all that has been changed. The filth theory of disease is dead. The parasitic nature of infection has been established, not by rash generalizations, but by laborious scientific work. The parasites of the infectious diseases, with rare exceptions, do not grow outside of the body; on the contrary, they tend to quickly perish. These diseases do not originate in filth, though a few of them are transmitted by certain kinds of filth. Typhoid fever and cholera are spread in fecal matter; dysentery may be; and it is possible also that some other enteric infections may be transmitted in this way, but, practically, no other disease which we are here likely to meet. By preventing fecal matter from one person from reaching the alimentary canal of another we can prevent typhoid fever and perhaps some of the other intestinal infections. To do this, public water supplies must be made pure and sewers must be constructed; but these are the duties of the department of works, not of the department of health. Milk and perhaps other foods must be protected from infection with danger-

ous filth, and the local board should do all it can in this line. The local board can and should enforce sewer connections, abolish privy vaults, and close dangerous wells. This is properly the work of the sanitary inspector, and is of real value in preventing disease. Most of his work, however, has to do with nuisances which have little relation to health.

If we look over the list of nuisances reported by the sanitary inspector of the average New England city, it will be seen that the most of them have little or nothing to do with the causation of disease. Most of the plumbing defects are trivial and harmless. The removal of dead cats, of ash heaps, of cellar rubbish, is not calculated to have much effect on the public health. Hen-houses, dog-kennels, and stables are usually a nuisance; but have they ever been shown to cause sickness? The same may be said of offensive trades. These and many more like them are nuisances; and our modern municipal civilization, and our sense of common decency, and fairness to our neighbors, require their abatement. But why not let the police attend to it, instead of the board of health? In glancing at the common forms of nuisance that are taken cognizance of by the sanitary inspector, it will be admitted, I think, that none except a few have any but the most indirect and occasional influence upon health. There are doubtless many other matters which are much more intimately connected with the public health, but which receive no attention from health officers.

If public health work were to-day to be organized for the first time, without prejudices, and by scientific men, sanitary inspection as now understood would receive scant attention. Its importance to-day is the legacy of unscientific theory. The abatement of nuisances in most cases accomplishes little for the promotion of public health and takes much time and money; and it is, moreover, a positive hindrance to sanitary progress. There is no question that the filth theory is still held in the highest respect by the public and a large portion of the medical profession, and by many health officers. The lately arrived immigrant complains at the health office that her "cesspool is running all over the yard, and she is afraid of cholera," the staid citizen wants the old pan closet removed from his hired house lest his children catch diphtheria, and even the well-educated

physician wishes the health officer to test the plumbing in his patient's house to see through what pin-hole the typhoid germs escaped. The daily papers and the medical journals tell us how modern sanitation — by which is meant municipal and domiciliary cleanliness — has reduced the death-rate and stamped out disease. Except to some extent in the fecal-borne diseases, municipal cleanliness has had little effect on the death-rate. We can never teach people the right way to avoid disease as long as they hold such erroneous views as to its origin. When the health officer devotes so much time to seeking out and abating nuisances, he is doing much to further the acceptance of most erroneous notions.

I am perfectly willing to admit that sanitary inspection has accomplished much in improving the homes of the poor and protecting them against the exactions of unjust landlords. It is a civilizing, and probably in a general way a wholesome thing to improve the dwellings of the poor and their surroundings. As you are perhaps aware, I am a firm believer in the importance and value of personal cleanliness as a means of preventing the transmission of the communicable diseases. It is personal rather than municipal cleanliness that health officers must teach. The latter may be left to other reformers. It is doubtless true that municipal clealiness may do much to teach and encourage personal cleanliness; but it is very doubtful if the regulation of many of the petty details which constitutes the bulk of the routine work of the sanitary inspector really accomplishes much in this direction.

Then, again, I firmly believe it is the business of the State to protect the individual against all sorts of nuisances. But most nuisances do not affect health except in a very indirect way, and there are many reasons why protection from nuisances should be afforded by the police department rather than by the health department. No medical knowledge is needed to abate nuisances. Nevertheless, law and custom have thrown this work on the board of health.

There will doubtless be very little dissent from my conclusions thus far that sanitary inspection and the abatement of nuisances are comparatively unimportant factors in the preservation of the public health, that they occupy a greatly undue portion of the time, money, and thought of sanitary officers, and that this undue promi-

nence operates most disastrously in keeping alive erroneous views as to the causation of disease; but, granted these premises, there may be great difference of opinion as to what should be done. My notions at present are somewhat as follows: —

First. We should lose no opportunity to teach the truth. When a person complains to us of a nuisance, although we may try to abate it, we must, if it is one which does not affect health, explain that fact, and state that it is abated simply on the ground that it is a nuisance. We must, morning, noon and night, teach that it is infected persons, not decaying matter, that cause the infectious diseases, and that immunity is to be sought not by municipal, but by personal cleanliness. Perhaps a carefully prepared circular on dirt and disease, for use as occasion demands, would not be amiss.

Second. It is worth considering whether it would not, on the whole, be better if the control of nuisances were vested in the police department. The department of health would then be relieved of much useless annoyance, and the public would be less likely to attribute so great sanitary importance to this work. The health department might then have more time and money to devote to its own proper work, such as the isolation of infectious diseases at home or in the hospital, disinfecting, quarantine, the inspection of schools, control of the milk supply, instruction of the public, and, what is most important, the scientific investigation of the all too numerous unsolved problems connected with these subjects.

Third. Don't look for trouble. As long as existing laws are on the statute books, it is necessary to carefully consider all complaints, and secure, if possible, the abatement of all real nuisances. It is perhaps necessary that the poorest class of dwellings — the slums, so called — should receive systematic inspection. Humanity and the public welfare require it, and at present none but the board of health will do it; but to make regular house-to-house inspections, seeking out and noting down a host of minor defects in plumbing or general cleanliness, is only placing ourselves in the false position of attempting to promote health by discredited means. The sanitary inspection of the house in cases of communicable disease should usually be avoided.

Fourth. We can oppose putting new nuisance work on the health

department. Smoke inspection and gas-pipe inspection are good things, but keep them out of the health department. It is very unfortunate, in my opinion, that the inspection of plumbing should so often be in the department of health. I opposed this in Providence, and there the inspector is an independent officer. Plumbing inspection ought to be merely a feature of building inspection. It is unfortunate that sanitary officials are the ones ostensibly responsible for the unnecessary requirements which are so often found in plumbing codes. The health department also should be relieved of all scavenging work.

In fine, while we should be vigilant to abolish such real dangers to health as the privy vault, the polluted well, or the anopheles-infected pool, we should interfere with nuisances not affecting health as little as the law and public sentiment will permit; and we should strive ever to educate the public to a proper understanding of the quite limited relationship of filth to disease. Nor should we deem it a discredit to depart somewhat from the teachings of early sanitarians and to modify their theories. Those soldiers present a far better defence who depend upon the accuracy of modern arms than those who cling to the scattering fire of the blunderbuss of our forefathers.

The President.— Discussion of this paper will be opened by Professor Sedgwick.

Prof. Sedgwick.— *Mr. President and Gentlemen,*— Dr. Chapin did me the honor to let me read over carefully his paper before he read it here to-day, and I want to say that I consider it epoch-making. It seems to me that health officers, and especially sanitary inspectors, have too often been in that attitude which is very well described as "barking up the wrong tree." Nothing is more annoying to an epidemiologist, nothing is more astonishing, I may say, than to see the misdirected efforts of members of boards of health. Only this very morning I visited a house in which ten cases of typhoid fever have appeared; and, asking if the board of health had been there, I was told that they had, and that they had first examined the plumbing and, secondly, taken a sample of the milk. I venture to say that

the examination of the plumbing was of absolutely no consequence whatever, practically, in hunting down the cause of that trouble, and, secondly, that the examination of the milk, inasmuch as it was two or three weeks after the disease had been taken by the victims, was also of no consequence whatever. I did not learn, though they may have done so, that the board had gone any further. And it is not this board alone that is given to work of that kind. Wherever I have seen the sanitary inspection of boards of health, I have been impressed with the large proportion of it devoted to barking up the wrong tree.

When I found that my friend Dr. Chapin, for whose opinion I always have the highest respect, himself a leading health officer of New England, a man conversant with all these problems, had written this paper, I felt that a better day was dawning. Here is a man who, from his experience, boldly comes forward, and says that a large proportion of the so-called sanitary work of boards of health is not in any strict and right use of the sense sanitary or medical work, and that it does not to any great extent contribute to the betterment of the public health, at least directly. Of course, a great deal of the work boards of health must always do will be of the very indirect kind, and no one appreciates that or values it more highly than I. It is only that the things that are the easiest to do are so apt to get done in a routine fashion, and the more difficult things are so apt to get neglected in a routine fashion, that makes it necessary for Dr. Chapin to bring this matter strongly and sharply before this Association. Take, for instance, some of the things that he has mentioned. Plumbing inspection,— that is a time-worn practice. When cases of disease are reported, go and look at the plumbing. Well, it does not do any harm to look at the plumbing; and I think we may say it does not do any good. It is well, of course it is essential, to have good plumbing; but the cases in which the disease reported had anything to do with the defects in the plumbing are very few and very far between. It has always seemed to me that boards of health might do a great many better things than that, and work which plumbers could not do and which ordinary inspectors could not do; but I have always been very modest about remarking on this subject, because I thought that I might not know the practical

difficulties of the work of a board of health. When, however, Dr. Chapin, with his large experience, comes forward and makes these statements, I give a hearty second to his idea. It seems to me that he has hit the nail very squarely upon the head.

I was hoping that something would be said on the sanitary inspection of tenements, and I daresay it will by others. I have seen a good deal of tenement-house work first and last, and it is pretty discouraging business. It seems to me that we have got to begin there a campaign of education. I am very glad that Mr. Aldrich is or was here, because I think that we have got here to co-operate with the teachers and the school authorities. I have maintained for a good while that it would not be at all a bad thing in a good many school-houses,— I have said this in the city of Boston, where the school-houses need attention more than they do in Brookline,— it would not be a bad thing at all, at least in many of the schools in that city, to spend the first half-hour in the morning in cleaning up the school-room,— in actually setting the children to work, I mean, in cleaning the desks, picking up pieces of paper, and seeing that the windows were clean. Why, there are many school buildings in Boston where the windows are washed only annually, or semi-annually, perhaps, and where dirt is all over the window. We have had meetings, school meetings, to deal with school hygiene, in rooms in which the windows evidently had not been washed for months. I know that it is an expensive thing to wash windows; but why not have the children spend a few minutes every day in cleaning up the school-room? That would be a practical lesson in sanitation which they could take back to the tenement houses, and which they would perhaps be inclined to put in force.

This thing has got to begin down at the ground. It is not enough to go and inspect tenements, and point out defects in space, and all that, although those are things that need doing. You have got somehow to make the people themselves desire cleanliness, and that is uphill work. But that it is uphill work is no reason why we should not begin on it somewhere; for we shall never get anywhere till we do. We never shall get tenements kept in anything like decent repair until the protoplasm or habits of the tenants have been made over somewhat.

A friend of mind, a bright young fellow, happened to own some tenements in New York City, down near the Mulberry Bend; and somebody got after him, and told him that he ought to put in modern tenements. He did so, fitted them all finely, had good plumbing put in, open plumbing even. When everything was ready, he said to the tenants in the neighborhood: "Now come in and live decently. Be 'white' people." They came in; and the first night they were there they sawed off all the lead pipe they could find anywhere, and sold it for old junk. Water ran all over the place, and his efforts went for nothing. What was the trouble? The trouble was not in him: the trouble was in the tenants. It was in their protoplasm and in their habits and in their education, which led them to be contented with dirt and filth.

I do believe that a board of health can do a great deal in tenement-house inspection. I think, to begin with, they must know what there is in their town. I think each half wants to know how the other half lives. I think there should be records kept of the houses, and of the sizes of the rooms and the chances for ventilation or non-ventilation; and any family that is particularly filthy, and likely to be a centre of small-pox or scarlet fever or diphtheria, or anything else, should have its place marked on a map. It should all be charted out and studied as an engineer would study an engineering problem. We want, in fact, to introduce a good deal of engineering into this subject. Those things noted should be kept as matters of record and matters of fact. There should be periodic inspections, but all such will go for nothing unless sooner or later we teach the people to desire cleanliness. That, as I have already said, is slow, uphill work; but it has got to be done, and I don't know where it can be done unless it is done in the public schools. And I don't know any subject to which the public schools might better address themselves than to the teaching of simple cleanliness and the love of cleanliness in children, because out of that might come eventually something better. If we don't get that, it is very certain that in tenement houses in the lower quarters of our cities and towns dirt will continue to reign; and disease, which always follows in the train of dirt, will continue to prevail.

It seems to me that in this line, and in those other admirable lines

that Dr. Chapin has mentioned, there is work in abundance — interesting, fresh, valuable, modern work — for boards of health. They should resist, it seems to me, the putting upon them of everything that nobody else will take. Because they have great powers, there is danger that they may be shorn of those powers some day, unless they limit themselves to their own business. The public will stand anything from boards of health in the direction of the restraint of disease; but it may some day become a question whether they will stand all sorts of regulations regarding plumbing and regarding gas inspection and smoke inspection, and so on. At any rate, why prejudice the normal and fine work of boards of health — medical, scientific, and truly sanitary work — by emphasis and great expenditures upon things which, after all, are secondary rather than primary? At the same time, I think it ought to be understood that anything that contributes to general cleanliness is to be desired and forwarded by boards of health. It is on this ground, of course, that nuisances have been given them to look after. But there is danger of exaggerating these easier things and of neglecting the more difficult, the more scientific, and more modern aspects of the work to which boards, in my judgment, should nowadays address themselves.

The President.— I will interrupt the usual list of speakers but for a moment by asking Dr. Durgin to give us some additional information, which I think he has in his possession, with regard to this collection of typhoid fever cases that Professor Sedgwick has spoken of. Dr. Durgin.

Dr. Durgin.— Gentlemen, I don't know what board of health is alluded to; but I want to say that I know of one board of health which does not look for typhoid fever in the plumbing and does not take specimens of milk in which to find the typhoid fever. I do know of a lot of cases of typhoid fever which were reported to the board of health about noon to-day. There is a department connected with this board of health which, under statute law, examines for the solids of milk; but it has nothing to do with typhoid fever. Instead of coming here this afternoon, medical officers have gone out to investigate these cases. There are, I

should say, more cases than Professor Sedgwick has named. Within a few minutes before I left to come here I learned that there were about fifteen cases in all, most of which had occurred among medical students and those who took their meals at a certain restaurant at the South End. Suspicion rests upon the celery and the milk, and those two suspected articles are being traced this afternoon. I shall be happy to report progress later on, but I don't want this board of health I have in mind to be looked upon this afternoon as barking up the wrong tree unless it is true.

Mr. Coffey.— Mr. President, I must confess that, as a layman, I approach this subject to-day with the utmost diffidence, considering the fact that the reader of the paper is a man of acknowledged position in the sanitary world and one whose opinions are entitled to a great deal of consideration; but, when Dr. Chapin very courteously a few days ago sent me a copy of his paper, I was rather amazed — and I thought to myself that I had heard before that this was the age of inconoclasm — that a good many of our cherished beliefs were being smashed, and I thought that this was another in the same line. I could not help agreeing, of course, with a great deal of what he said; but it struck me that he was going too far in the deductions he drew from the facts, recited.

All health officers who have had very much experience are aware that we know the germs which cause several of the infectious diseases; but do we know all the conditions concerning them? Take the question of diphtheria, for instance. That is caused by the Klebs Loeffler bacillus; but yet we know, from the experience of every man connected with medical work or with health work, that there is a disease which is called pseudo-diphtheria, which closely resembles it,— resembles it so closely, indeed, that the best physicians are misled, and cannot pronounce authoritatively upon the case without a bacteriological examination. This disease, which resembles diphtheria so closely as to deceive the best practitioners, is caused by other germs. It only differs from diphtheria in the profound toxæmia which follows the true diphtheria; and yet I am told by the bacteriologists that under other conditions these germs give rise to other diseases. The point that I want to make is that, while we

know that diphtheria *per se* is caused by the Klebs Loeffler bacillus, we don't know in that disease or in any other infectious disease all the causes that go to make up the conditions that make the introduction and the growth of the bacteria in the human subject possible.

I have always believed, and I still continue to believe, that pure air is a necessity for good health; and, if the average health officer should allow the abatement of nuisances to be transferred to some other department, any practical man who has had experience in health work knows that those things which are transferred, those things especially which have anything to do with cleanliness or with health that are in the hands of other departments, would not be very well looked after, because those departments do not realize the importance of this work. It is purely mechanical with them. They do it as a matter of duty. They do not realize, as I said before, how important it may be. One thought that has suggested itself to me is this: If dirt and impure air have no more effect upon disease or upon health than one would be led to suppose by Dr. Chapin's paper, why is so much money being spent, and why is so much being done in all the hospitals of the land, in the way of aseptic preparations in the surgeries? Take the one disease of puerperal septicæmia. We know that a few years ago it was quite common, and we know that certain diseases followed surgery which was not aseptic. To-day it is almost a disgrace in the medical profession to have a case of puerperal septicæmia. It is the same to-day in any hospital to have a wound become infected. Now hospitals, as a rule, are very clean. It is not the specific germ of diphtheria, nor of typhoid fever, nor of those other specific germs that we are acquainted with, that contaminate the instruments or the bandages or the finger-nails of the doctor: it is dirt — it is dirt either in the concrete or in the atmosphere — which serves as the vehicle of infection.

Take the question of plumbing. We know that a few years ago, comparatively few, the average tenement house was very often filthy in the extreme. The health departments took up this question of plumbing; and they insisted on having sanitary plumbing, open plumbing, so that the boards and the things that went to conceal and did conceal dirt were removed. And there is not any question

in the mind of anybody that the conditions for health are improved because of it. We are told, and we know in our own cases, that the mortality rates are being decreased all over the world, that, as sanitary science — and sanitary science, as we have understood it, included the abatement of nuisances and the removal of dirt — has progressed, it has led all over the world to better conditions, longer lives, and more health-giving surroundings.

Take the question of stable manure, to which Dr. Chapin alludes, and the general dirt surrounding the premises of a house. We know now that the fly is an important agent in the spread of disease, and we also know that the fly breeds in stable manure. If we allow heaps of animal refuse to remain about the dwelling or in the dwelling, are we not giving the best of conditions for the propagation and the growth of flies?

I might go on and enumerate other things that have occurred to me; but I had not time to prepare any paper, and these remarks of mine, as a matter of course, are disconnected. They occurred to me as I was thinking the matter over while on the train to-day. But while I am willing to admit, as I said at the beginning, that a great many of Dr. Chapin's statements are true, that health departments are very often called upon in trivial instances to abate things which are really offences to the æsthetic sense rather than real injuries to health, still they go with those other things. How can we separate them without losing sight of some things that are important and that must be attended to, if we are going to have pure air? As I said once before, pure air, it seems to me, is a necessity for good health. I don't know that I can add anything else. I know, of course, with other health officers, that we have found out the causes of certain diseases; but, after all, are not those very few in comparison with the great realm that remains to-day unexplored? Are we not rather on the verge of a great sea, with here and there a beacon light, while the great mass of the waters remains uncharted?

Mr. Thomas Jordan.— *Mr. Chairman and Gentlemen*,— I want also to thank Dr. Chapin for forwarding me a copy of his paper before the meeting; but I think that, as a layman, I should not enter into a discussion as regards the technical relation between sanitary

inspection and infectious diseases. I must leave that to the physicians; for, when they disagree, I ought not to take sides one way or the other. I will, however, say that the public does not always heed the education offered by boards of health of which Dr. Chapin speaks.

I remember that a short time ago we made an inspection of a house on Pembroke Street in Boston, where there was a case of diphtheria. The patient, a child, died; and the woman of the house sued for damages. Our physician, Dr. Brough, who was called upon to testify, stated before the jury that he thought the plumbing had no connection at all with the diphtheria, and that, as a matter of fact, bad drainage had no connection with diphtheria. In examining that case, we had found a defect in the drain eight feet under the ground, at the connection with an earthen and an iron pipe; and that was the cause of the suit. Notwithstanding the fact that Dr. Brough tried to educate and impress the jury in regard to that matter, they awarded $5,600 damages to the plaintiff. You see that education did not speak for much in that connection.

I am here to-day to speak on the sanitary inspection of tenement houses. The statute law obliges us to make an inspection of all tenement houses in Boston twice a year, and of course we have to obey the law. Until such time as the law is changed, it will be necessary for us to make these sanitary inspections. We have distributed among the gentlemen of the Association here a blank form that we use in making these examinations. In every tenement house we examine first the drainage. We inspect the drainage of every tenement house in Boston twice a year. I will say in this connection that in Boston we have about 5,000 tenement houses,— a little over 5,000. Tenement houses in Boston and in the State of Massachusetts are houses built to accommodate four families: in New York and other large cities are three-family houses; and I think that we should be better off here, as far as improvements are concerned, if the tenement-house law was enforced in the same way here as it is in New York,— if a tenement was construed as being a house to accommodate three families instead of one to accommodate four,— because we find in our sanitary inspection that the three-family houses require just as much attention as four-family houses do.

We also test the drainage in cases of diphtheria, typhoid fever, and consumption. It seems to me that, in looking after cases of consumption, much good is done by the sanitary inspector, and for this reason : We go to each house where there is a case of consumption reported, and under the regulations of the Board of Health of Boston cases of consumption are now required to be reported to the office. We find out just how the patient is living. Of course, it is essential in the case of consumption that a man should live in a clean place, have a good, airy room, and be separated from other people. We often find that the patient sick with consumption is sleeping with somebody else; and we, of course, give instructions to have him sleep in a separate room, away from other people, so that, in my opinion, some good is done in that way through sanitary inspection.

We also very often find in testing the drainage of houses that there are no connections with the sewer, and that brings to my mind a case that I remember a few years ago in one part of the city. I went to examine a stable, and found the cellar of the stable full of water. I notified the owner of the condition of the stable; and he said that it was a spring that had been running in there for a number of years, but he did not know how he was going to get rid of it. I told him that he had better pump the water out, and then we would look it over. He did so. After he had pumped the water out a second time, I went to visit the stable. I detected an odor which I thought was the smell of a disinfectant that was used in the sanitaries of a school-house about five hundred feet away. In making a test from that school-house, I got a return in the cellar of that stable; and, when the men dug, it was found that this school, which had been supposed for years to be connected with the sewer, was draining into the cesspool, and from the cesspool into the stable cellar.

We very often find in making inspection of tenement houses that traps siphon because they do not have proper ventilation. In Boston most of the tenement houses were originally dwelling-houses. A large part of them have been converted from one or two family houses into tenement houses, and traps have been supplied from time to time; and, as a rule, until we asked to have them supplied, we very seldom found a running trap, so that in the cases where the S traps siphon it means an open drain to the pipe sewer in the street.

In these old houses which have been altered over, as anybody who has had occasion to examine them will find, in the old times the water closets were placed in some out-of-the-way place, either under the stairs or down in a dark corner of the cellar, or some place of that kind, where they would not take up much room and where they would be "out of the way." In fact, people generally put the water closet in those days in these houses where they could not put anything else. We have done a great deal of work in the last three or four years in having these water closets removed and placed where they are light and airy, and also in supplying an additional number of them. As a rule, when they alter these old houses over, they increase nothing except the number of people that live there.

We also find in these houses, which were originally intended for one or two families, that they have been cut up by partitions in every imaginable sort of way, so that a large number of the rooms are without light or air whatsoever, except what may be gained from the other rooms. At the present time, in making this tenement-house inspection, we oblige the landlords either to convert a small room at the rear into an addition to the larger room or else to provide shafts for light and ventilation. Another trouble that we find is that houses that have been built for three families are afterward converted into four and five family houses. While they are not on record in the building department as tenement houses, they have become converted into tenement houses. This is done by letting the basement, as a rule, for a store. The storekeeper goes in and partitions off the part of the basement at the rear of his store for a bedroom, and very often makes two partitions, converting the space into a bedroom and kitchen, with the bedroom between the kitchen and the store, and with absolutely no light or ventilation. We also find in these tenement houses that the hallways are very poorly lighted. Under the law, in a tenement house all halls are obliged to have a window opening to the outer air; but in these houses that have been altered over we very seldom find it, so that we are obliged to ask that additional light be provided, either by cutting a window or by putting glass panels into the door of the room so as to afford light through into the hall.

Another trouble that we find in the tenement-house district of Bos-

ton is the overcrowding. This can only be determined at night-time. We have to go about in the night and into these tenement houses, and I must say that the people always take these visits very good-naturedly. It is very seldom that we meet with any trouble at all, as we go in and pass through the bedrooms. What I am about to describe is especially the case in the winter time. The people who labor on the sewers and railroads in the country during the summer time come to town in the winter time, and hire one or two rooms and herd in together; and sometimes they crowd in as many people as it is possible for the place to hold. As a rule, you will find that those rooms are dark. They are not only dark of themselves, but these people hang up overcoats, blankets, and things of that kind, so as to exclude every possible particle of air that they can. Invariably, you will find either a red-hot stove or a kerosene lamp lighted all night long. So you can imagine the condition of the place. These are things that we are obliged to attend to under the law twice a year.

Another great trouble that we have in Boston is the alleys, the rear alleys. Those are things that occasion us more trouble than anything else, for the reason that everybody dumps all his débris into them; and we have nobody to get after to clean up except the owner. Very often the owner lives out of town, and has had no hand in the filth that has accumulated there, does not know anything about it; but under the law he is the only person that we can oblige to clean it up. Our board has very often sent communications to the city government, asking that an appropriation be made and the matter taken care of by the street department in connection with the cleaning of the streets, which could be done very easily; but we have always failed to get an appropriation for the purpose.

Another thing that we have to attend to in Boston under the law is the cheap lodging-houses. There has been a wonderful improvement in regard to them within the last few years, since the board of health made a code of rules governing them. Now no lodging-house can go into business or get a license from the police department until it complies with the rules established by the board of health. I remember a few years ago we went down to the West End, where we found thirty-five people sleeping on the floor of one room, with

not a stick of furniture of any kind in the room, and nothing on the floor except newspapers that some of the particular lodgers had placed under them to keep them off the boards. This room was about 10 × 15 feet. The charge for lodging there was five cents.

Another matter which has been turned over to the board of health by a law which was passed in 1897, and amended in 1899, is the removal of old buildings; and this, I think, is a matter in which the board of health has done good work in Boston. We are going through the city, and have been for the last three years, tearing out the old wooden structures in the rear yards, and wooden ells that have gone to decay, depriving the main part of the house of light and ventilation. In some instances we have gone into the rear part of the lot, and have taken down whole buildings, in order to improve the light and air for the main or front building.

It seems to me that this is good work. We feel in Boston that we have been doing pretty good work in regard to this inspection of tenement houses. Of course, as I said in the beginning, it is not for me, as a layman, to criticise a paper like Dr. Chapin's, because I know very little about that part of it.

Mr. Coffey.— With your permission I want to add one thought that I forgot in connection with my remarks; and that is that, while we do not claim in Worcester that filth causes disease, what we do think and have thought is: Hasn't filth, and its consequent impure air, a devitalizing effect upon the human system, so that people more readily contract disease when they are brought in contact with it? In other words, are persons who are sleeping in unsanitary houses, with unsanitary closets, and with refuse and filth about, as healthy, and is their vitality as good, as those who are living under good sanitary conditions? In Worcester we have gone on in this way, considering that good air was a necessity, and that good plumbing, sanitary plumbing, and clean yards are necessities. We are a large manufacturing community. Our city is the second largest in the State, and has 125,000 or 127,000 people. It is entirely a manufacturing community. All kinds of people are there. Turks and Armenians, and Greeks and Italians, and Swedes and Irish, and French and Jews, all go with native population to make up this

community. And yet the last report of the State Board of Health gave us a mortality rate of something over 14. I think that will compare very favorably with the mortality rate of any large city in the country. It is not due entirely to the better knowledge we have to-day of infectious diseases. In my opinion, it is due largely to the magnificent water supply we have got, to the sanitary plumbing which we have enforced for the last dozen years, to the fact that our houses are not crowded, but are isolated, each house having its own little yard and windows on all sides, and that sun and air are supplied in unlimited quantities. Our effort has been to try to give the people pure air by keeping the yards of the houses and the surroundings clean, and it seems to me that that is an important factor in improving the health conditions.

The President.— The subject is now open for general discussion, gentlemen.

Dr. Magee.— I feel that this is a very important subject, and I see some of our laymen have laid some stress on the medical practitioner. I, as one, feel that it is hardly right for a layman to do so. One speaker named septicæmia and other kindred diseases, saying that the medical practitioner is ashamed when he gets hold of a case of the kind. That is not so in medicine. Septicæmia has been from the earliest days, it will be probably till the end of the earth; and there is no practitioner to-day who has a large amount of work to do but will find cases of septicæmia in his practice.

But, coming down to the subject of Dr. Chapin, I feel that his paper to-day has been confirmed by the sanitary inspector of the City of Boston. Brother Coffey in his last remarks has also confirmed the paper of Dr. Chapin by his statements. Cleanliness, fresh air, to the people, I think, are more important than sanitary plumbing. There is no doubt that good sanitary plumbing is a Godsend; but I do think that the intelligent people of to-day, and especially the medical profession of to-day, say, "Give us large, well-ventilated, and open rooms, cleanliness of your floors, cleanliness in what you do." I think, if the board of health could educate the people up to that, we should have less contagious disease than we have to-day.

Dr. Durgin.— I wanted to compliment Dr. Chapin in courage and in sentiment. He has done what I hoped he would do. If we cannot all agree upon every point, that is nothing against the paper. It is a good and timely paper. The trend for the last quarter of a century has been in this direction. In my department in Boston we are performing sanitary inspection as a police branch of our service. The work upon infectious disease is done by professional men, in the manner which is recommended by Dr. Chapin in his paper and by Professor Sedgwick in his remarks. I thoroughly agree with both gentlemen in this method of doing work. The time may come — it may not have come — when these two lines of work may safely be divorced, and the police or sanitary inspection be performed by some other branch of the local government. There is this, however, to be said in doing this work, one in connection with the other; and that is that you will scarcely ever make this sanitary inspection without running across that which you must do in finding and treating infectious diseases. I have been reminded by the speakers this afternoon of this one fact: the night work referred to by Mr. Jordan has been most prolific in our experience in finding infectious disease, which would have been found much later, if found at all, had it not been for this police service; and so, too, it may be said in many other branches of this police work.

The President.— Is there anything more to be said upon the subject of this paper? If not, the next paper upon your programme is by Dr. Chase, "The Abatement of the Mosquito Nuisance in Brookline."

Dr. A. E. Miller.— Mr. President, I wanted to say just a word on that point, if it is not too late. I think a great deal of Dr. Chapin's paper; but are we not liable to sway a little too far the other way? One would almost think it was not necessary to pay any attention to the plumbing, from some remarks that have been made. Every one admits that cleanliness is very important. I have in my mind now a tenement house, and I know several similar ones, where the lady of the house is scrupulously clean and neat; but she went into a house where the plumbing was so bad that it was an

impossibility for that family to have things in decent condition. Bad odors were arising all the time from improper plumbing. While we all admit the importance of pure air, cleanliness, and everything of that kind, can we have cleanliness unless we have proper plumbing? That is a point, I think, we want to look squarely in the face; and we must not be swayed too far the other way. I think it is impossible to have cleanliness in many of these houses unless we have proper plumbing.

THE PRESIDENT.— I now present Dr. Chase, the reader of the final paper of the afternoon.

ABATEMENT OF THE MOSQUITO NUISANCE IN BROOKLINE.

BY H. LINCOLN CHASE, M.D., AND J. ALBERT C. NYHEN.

The great prevalence of mosquitoes every spring, summer, and fall in certain sections of Brookline, the increasing number of citizens in every part of the town, the comparatively recent discovery that intermittent fever is transmitted from a patient to well persons through the bite of a mosquito,— these facts moved five intelligent and influential citizens of Brookline to petition the board of health on Aug. 13, 1901, to consider the feasibility of suppressing the mosquito nuisance. The petition further stated that not only the health and comfort of many citizens was concerned, but that the value of real estate in certain localities was likely to be affected, and that, therefore, the question was for several reasons well worthy the serious consideration of the board of health. About the same time a number of letters of the same general purport were received from individual citizens, bitterly complaining of their inability to enjoy their piazzas or grounds after sundown because of the mosquito.

At its next meeting the board of health voted to refer the matter to its agent, Dr. Chase, for investigation and report, with recommendations. The report was duly made, and summarized most of the information then available on the subject, much of which was

secured from Dr. Theobald Smith's valuable and interesting paper on the subject given before this Association at its meeting in July, 1901, partly from Dr. L. O. Howard's book entitled "Mosquitoes," and much also from the experience of our medical officers in Cuba in suppressing the mosquitoes that transmit malaria and yellow fever. The board promptly authorized its agent to proceed along the lines recommended in his report.

We prepared a list, with the help of our police department, of nearly all the stagnant water in the town. We next marked the exact location of all these places on the town map, and had them systematically inspected and reported on by Mr. Nyhen, the board of health laboratory assistant, as to the presence or absence of larvæ, and of their natural enemies, frogs and fish.

An examination was also made of a number of our street catch-basins; and, with the exception of those few that received large quantities of cold water from neighboring stand-pipes, all were found to be teeming with mosquito larvæ, all of which were those of culex. Our largest body of water, Leverett Pond, was found at that time to be entirely free from larvæ, minnows and other fish being quite plentiful. Other ponds that had either no larvæ visible, or only very small ones, were found to be well supplied with frogs. Most of the ponds, pools, and ditches, however, were found to be breeding-places of mosquitoes, all furnishing larvæ of culex in abundance; and quite a number, notably those off upper Boylston Street, where malaria has been more or less prevalent for some years, had numerous larvæ of anopheles.

We secured a barrel of light fuel oil; and, in September, Mr. Nyhen, with the help of a laborer and a horse and wagon, treated a single time all of the breeding-places of anopheles and all the more important breeding-places of culex in the more thickly populated sections of the town, including 250 catch-basins. Every pond surface was measured more or less accurately. Light fuel oil was then applied and the surface of the water well agitated with a pole to hasten the diffusion of the oil. As an experiment, we also put quick-lime into a few shallow pools, but were rather disappointed in the results. Later we filled in all shallow pools. The oil treatment we found very successful as a temporary measure, especially in the catch-

basins, all of which, almost three weeks after treatment, remained wholly free from larvæ.

At the same time that we began to treat the larger breeding-places of mosquitoes, we distributed by the police to each family in town the following circular of information : —

Office of the Board of Health,
Brookline, Mass., Sept. 9, 1901.

MOSQUITOES.

Both malarial and common mosquitoes are numerous in Brookline, and the Board of Health invites the co-operation of citizens in its efforts to diminish their numbers and to reduce the areas in which they breed.

Mosquitoes always lay their eggs in water, as the young (larvæ) cannot live elsewhere. They rarely fly far, and their presence is usually accounted for by the existence of standing water close at hand. The eggs and larvæ abound throughout the season in ponds, pools, puddles, cisterns, rain barrels, water buckets, old tin cans, clogged gutters, and, in fact, anywhere that even a very little water is allowed to stand for a few days.

Experience in other places has shown that much good can be accomplished by giving attention to all the standing water in any neighborhood. In permanent ponds, fish and frogs, if in sufficient numbers, will destroy the eggs and larvæ; but care is needed to see that small pools around the edges are filled up or treated with oil. Unnecessary pools and puddles of all kinds should be drained or filled up. A little kerosene oil (preferably "light fuel oil") put into standing water spreads easily and rapidly over the surface, and, without injuring the water for other purposes, destroys the larvæ, which are unable to breathe, and prevents the laying of eggs. An ounce of oil is sufficient for fifteen square feet of surface; and an application of it is effective for about two weeks, at the end of which time it should be renewed. Good results have also been obtained by putting unslaked lime into standing water.

The mosquitoes which live through the winter in cellars and barns, under bridges, and in other sheltered places, lay eggs again in the following spring; and it is believed that active measures taken now will materially reduce the numbers to survive the winter. The Board intends to treat some of the worst places in town with oil at once, and to remove certain stagnant water entirely, and also to follow the matter up closely early next year. Citizens are urged to look after all standing water on their own premises.

By order of the Board,

James M. Codman, Jr., *Chairman.*

H. Lincoln Chase, M.D., *Agent.*

Outfit of 1901.

Mr. Nyhen was given the personal supervision of the work in the field, under the direction of the agent of the board. He was

allowed one laborer at $1.75 per day to assist him. Our equipment consisted of: —

1 hired horse and light wagon.
1 outfit for collecting specimens of larvæ, pupæ, and adult mosquitoes.
1 five-gallon oil-can.
1 single-gallon watering-pot.
1 brass spigot.
2 galvanized iron oil dripping-pans.
1 pick.
1 funnel.
50 gallons light fuel oil.

Beginning the work in September, we hoped to destroy the last mosquito larvæ of the season, the ones that otherwise would have matured and lived through the winter, to produce the first brood of mosquitoes of the following spring. So much for the season of 1901.

Early in 1902 the board appropriated a moderate sum of money for mosquito work, and those in charge prepared to make an early start. For various reasons, however, work could not be begun until early in May; while the mosquitoes appeared in considerable force late in April.

A second circular of information, more particularly in regard to the cause and prevention of malarial fever, was prepared, and distributed by the police to every family in town. This circular was as follows: —

CIRCULAR OF INFORMATION IN REGARD TO THE CAUSE AND PREVENTION OF MALARIAL FEVER.

Office of the Board of Health,
Brookline, Mass., May 26, 1902.

Many physicians now believe that malaria is transmitted from one person to another through the bite of a certain kind of mosquito, and that, where conditions are not favorable for breeding mosquitoes, malaria is unlikely to obtain a foothold or to spread.

The Board of Health desires to prevent all chance of malaria in Brookline, and invites the co-operation of citizens in taking certain simple precautions.

Malaria has recently been included among the diseases to be reported to the Board of Health by physicians or by householders where no physician is called.

Great care should be taken to prevent mosquitoes from biting any person who has malaria, since it is only by biting such a person that they are enabled to transmit the disease to others. This is one of the most important things to be kept in mind when a case of malaria occurs.

As mosquitoes breed only in standing water and often in quite small pools and ditches, a great many of them can be destroyed by filling up or draining off holes and pools and emptying water barrels, pails, clogged gutters, tin cans, unused cisterns, and other receptacles. When, for any reason, standing water is unavoidable, a thin coating of kerosene oil spread over the surface kills the young mosquitoes.

Much can be done by individuals to supplement the work of the Board. All citizens are urged to help, especially in the direction of doing away with unnecessary standing water, however small in amount. Kerosene poured upon water from a can or pail spreads rapidly over a considerable surface. With an ordinary hand pump, such as is in common use for washing windows, a greater area can be readily "petrolized." The Board of Health should be notified of all pools which cannot be taken care of by individual effort.

By order of the Board of Health,

James M. Codman, Jr., *Chairman.*

H. Lincoln Chase, M.D., *Agent.*

In response to the request to the citizens to report all probable breeding-places known to them, numbers of notifications were received.

The Outfit for 1902.

Mr. Nyhen was placed in immediate charge of the work as previously, and most of the season he had at his disposal two laborers at $1.75 each per day. The equipment consisted of most of that of 1901, and in addition we had the following list of articles: —

4 five-gallon oil-cans.
1 ten-gallon oil-can.
2 picks.
2 hoes.
2 rakes.
2 shovels.
2 scythes.
2 Breck hand force-pumps.
3 one-gallon watering-pots.
16 feet of hose in three sections.
3 galvanized iron pails.

2 pairs of deep-water leather boots, for use by men handling oil.
3 pairs of deep-water rubber boots.
1 zinc wagon pan.
500 gallons of light fuel oil.

This outfit proved to be somewhat inadequate, but the tools and utensils used were as suitable as could be found. More satisfactory tools might be devised. We badly needed two or three more laborers.

Methods of Work.

(1) All pools, ponds, ditches, and other breeding-places, including catch-basins, were located upon the town map. We also located and treated a number of breeding-places just beyond the town's borders.

(2) The approximate areas were determined, and the number of catch-basins ascertained.

(3) Breeding-places of culex and anopheles, respectively, were determined, and also the places where both species were breeding. This we did in order to learn the proper intervals for treatment; that is, whether every three weeks or every four weeks.

(4) The location on the town map of the public dumps or other places where accidental receptacles of water were to be found; for example, tin cans, boxes, etc.

(5) Details of treatment, temporary or permanent. Petrolizing, and necessary work preliminary to it. Last, but most important of all, filling or draining.

Treatment of Catch-basins.

Three ounces of light fuel oil we found to be the necessary quantity for each treatment of one of our street catch-basins. This will keep the catch-basin free from larvæ, and prevent mosquitoes from laying their eggs for a period of about three weeks. The laborer partly removes the cover of the catch-basin with a pick, thrusts his watering-pot two-thirds full of oil into the opening, and about a foot below the street level he makes one turn and one-half with his wrist, the oil flowing freely through the sprinkler nozzle, and only being permitted to run during the wrist movement. The amount

stated (3 oz.) is, of course, only approximate, but is sufficiently accurate. Thus 950 catch-basins have been treated six times during the season just ended. The amount of oil used in one treatment of the 950 catch-basins was 2,898 ounces, about three pints in excess of the calculated amount (*i.e.*, 3 oz. for each), 2,850 ounces. The excess never exceeded one-half gallon of oil on 950 basins. If rubbish was found in the basin, the water was well agitated by the petrolizer. The entire treatment of a basin took from two to five minutes, depending upon the ease with which its cover was replaced.

The Treatment of Ponds and Ditches.

The amount of oil used for a given pool or pond we determined as follows: Calculate the amount necessary from Dr. Howard's rule, one ounce of light fuel oil to 15 square feet. If the pond had vegetation growing luxuriantly in it, irregular shores, and a large amount of vegetation about it, we added an excess of one-fourth of the original amount. If the pool presented a clear water surface, we added one-sixth more than the usual amount. Pools well stocked with fish did not require a film of oil over the entire surface; but a belt about 15 feet in width, extending around the shores, was thoroughly treated.

If a pool or pond had fish or frogs in it, we examined it very carefully until we were satisfied that it was not a mosquito-breeding pool; for we found a number of ponds well stocked with fish and frogs were, nevertheless, breeding-places of culex and anopheles. We found that the film of light fuel oil did not kill the natural enemies of mosquito larvæ; namely, fish, frogs, etc.

In treating ditches, the amount of oil was calculated and distributed as evenly as possible; and, if necessary, the water was well agitated.

After the oil had been evenly spread upon the pond from the most favorable working points, a man styled the "puddler" violently agitated the water with a hoe. These photographs, kindly taken for us by Dr. Walter G. Chase, show very faithfully some breeding-places of mosquitoes and our methods of treatment. At the end of a week the superintendent examined the water for traces of breed-

ing. He depended on his own observations, and not on those of his untrained men. There were many details to be carefully attended to: otherwise, the men would not always apply their efforts to the best advantage.

The treatment of pools, ponds, and ditches where rank vegetation was abundant, was begun by removing this vegetation with scythes as completely as possible for the distance of fifteen feet from the edge of the pool to be treated. The shallow pools, if not large in area, were filled in with material from the immediately higher land. If a pool stood near a dump, we gathered into it accidental receptacles and covered them with sufficient soil. We drained or filled in many small pools.

Many problems arose in this work, and methods and their solution had to be devised by the superintendent.

Accidental Receptacles.

We found in our public and private dumps very many small receptacles of water which proved to be important breeding-places of mosquitoes, especially for anopheles. We gathered all metal receptacles that would hold water, and either used them in filling up pools or buried them. Bottles and wooden receptacles, and vessels of breakable material, we simply broke up.

Reports of Progress.

From time to time we prepared reports to the board of health of progress made in our work, of which the following is a sample: —

REPORT OF PROGRESS ON MOSQUITO WORK.

Brookline, Mass., May 26, 1902.

To the Board of Health:

Gentlemen,— Since the report on mosquitoes, sent in on May 19, over 950 catch-basins have been thoroughly treated with oil. The locations are shown on the accompanying chart. The ditches in the Washington Playground have also been treated. Of the 550 remaining catch-basins, about 150 need to be treated, also the ponds on the Wright estate, and those near Hammond's Pond, in the Chestnut Hill District. Permission has just been received for treating the ponds on the Wright estate. We may add that no one, thus far, has objected to our work on private grounds. These ponds were found to be breeding malarial

mosquitoes, as well as the common mosquito. After treating the Wright ponds and the 150 catch-basins referred to, it will be necessary to sprinkle again the pools first treated. If the weather becomes cool, their second treatment will be deferred for a week, and work will be done on the as yet untreated Chestnut Hill pools, and in clearing the banks of the most centrally located stagnant water in the town.

In order to fill in the shallow pools on public dumping-places and to prepare a large number of ponds and pools for more effective and more economical petrolizing, the recommendation made last week is renewed; namely, that three additional men be employed for a short period. After this extra work has been accomplished, two men, with such supervision as Mr. Nyhen will have time to give, will be able, in my opinion, to attend satisfactorily to the work during the rest of the season.

I earnestly hope that the matter may receive the early attention of the Board, and that it will favorably consider requesting the necessary appropriation for this work at the June town meeting.

Respectfully submitted,

H. Lincoln Chase,
Agent of Board of Health.

Of course, petrolizing is but a temporary expedient: only draining or filling in can result in a permanent removal of a mosquito breeding-place. To this end the board directed Mr. Alexis H. French, Town Engineer, to examine and report upon, with reference to their drainage, several sections of swamp land, and to furnish an estimate of the probable cost of the drainage. In this connection the following letter from Dr. Abbott, secretary of the State Board of Health, is of interest: —

Boston, May 22, 1902.

Dr. H. L. Chase, Agent Board of Health, Brookline:

Dear Doctor,— In reply to your further inquiry, on behalf of your Board, there can be no doubt that wet lands and stagnant bodies of water constitute a serious nuisance, especially in thickly settled towns, since, when the question is considered both subjectively and objectively, the presence of human beings is essential to the existence of a nuisance. Wet lands in uninhabited districts are of course not dangerous, because there are no human beings to whom they may prove harmful; but in large towns the case is necessarily otherwise.

The Statutes (Revised Laws, Chap. 75, § 75) already provide that "land which is wet, rotten, or spongy or covered with stagnant water, so that it is offensive to residents in its vicinity or injurious to health, shall be deemed a nuisance"; and the recent discoveries relating to the dangerous nature of insects bred in such places only strengthen the statement expressed in the Statutes.

Yours respectfully,

Samuel W. Abbott,
Secretary.

The final treatment for the season of all the catch-basins and other breeding-places was given during the month of September.

Results.

Our work had not been going on more than a month when many citizens noted and favorably commented on the marked diminution in the number of mosquitoes in the formerly infested districts, especially the Longwood District. The work went steadily on; and the results were such that the board of health soon increased the mosquito working force from one laborer to two, and provided a little more money. So great an improvement was noticed in every district treated that letters of commendation from many representative citizens were received. Below are given a few extracts from some of these letters: —

Brookline, Mass., July 24, 1902.

Dr. H. Lincoln Chase, the Board of Health, Brookline, Mass.:

My dear Dr. Chase,— Let me most heartily congratulate you upon the splendid success you have achieved in connection with the mosquitoes. I am indeed delighted, and you are deserving of all the congratulations and expressions of praise that you will receive from all hands; and I am glad to see that the Boston papers are giving you a little of the commendation that is due you. As a matter of fact, in my opinion, you are entitled to just as much praise and credit as though you had cleaned out a deadly disease; for, truly, Brookline in 1901 was so utterly unendurable that there was no comfort or enjoyment in living there at all, but now it is entirely different. I am almost never troubled now in any way, and I believe that, with the valuable work you are doing, another year will see the end of these infernal pests.

Very sincerely yours,

—— —— ——.

Brookline, July 25, 1902.

Dear Dr. Chase,— You may be interested to know the state of matters on our golf links since the pond was petrolized. Before that was done, the mosquitoes were infernally affectionate, and took all sorts of liberties with the players. Since the first application of the petroleum, there has been a very marked change for the better. In going through the ravine, we now seldom see a mosquito, and are not troubled by them in the least. Whether the cool weather has anything to do with this gratifying state of affairs, I do not know as well as you do.

I wish to express to you and to the Board of Health of Brookline our appreciation of the good work done on upper Boylston Street in this matter.

Very truly yours,

Geo. W. Gay, M.D.

The most important object of this work — namely, the prevention of malarial fever — should not be overlooked. In December, 1897, the agent of the board wrote to most of the practising physicians of the town, requesting each to report to him, as a favor, the number and location of his malarial fever cases, of tertian type only, seen by him during the previous season. The total number of typical cases reported was not less than fifty. The past season the board of health has required the reporting of every new case of malarial fever, and has received notice of only twelve cases.

The writers regret that the latter part of the past season was unusually cool, thus making a test of the work somewhat less severe than during the earlier part of the season.

The total cost of this work, up to the middle of September, in addition to the loss of time involved in its supervision, was $625.57. With the expenditure of twice this sum the next season, even more satisfactory results could be obtained.

In our work we had assistance from our bacteriologist, our town engineer, our superintendent of streets, our park commissioners, and some other town officers.

We have made a beginning; and we venture to hope that in a year or two, with the co-operation of the adjoining municipalities, Boston and Newton, we may have a town where malarial fever* will no longer exist, and where mosquitoes will be too few to be a nuisance.

CIRCULAR OF INFORMATION FOR FAMILIES IN WHICH A CASE OF MALARIAL FEVER IS REPORTED.

Office of the Board of Health,
Brookline, Nov. 15, 1902.

It is now quite generally believed that malarial fever is transmitted only through the bite of a certain kind of mosquito, the anopheles. It is probable that localities are malarial only because they furnish favorable conditions for breeding these insects. Even in such districts, however, malarial fever does not occur unless some human being comes there with the disease and is bitten by the anopheles mosquito.

It is very important, therefore, that mosquitoes should be kept away from any person who has malaria, since it is only by biting such a person that they become

* Appended is our latest circular of suggestions for families in which cases of malarial fever may be reported.

dangerous to others. As mosquitoes breed only in standing water, and chiefly in quite small pools and ditches, the importance of filling up holes and pools, and emptying water barrels, pails, clogged gutters, tin cans, and other receptacles, is very great. As far as possible, all land with stagnant water on it should be drained.

Mosquitoes often remain in a house through the winter, and become dangerous on the return of warm weather. The Board of Health is taking precautions to prevent the spread of malaria in Brookline, and invites the co-operation of citizens, especially in the direction of doing away with all unnecessary standing water, however small in amount.

The following precautions should be taken at once in every household in which there is a case of malaria: —

(1) The prompt treatment of the patient with quinine, under the direction of a physician. The quinine destroys the malarial organisms in the blood, and therefore serves both to cure the disease and prevent its being transmitted to others.

(2) *The protection of the sick persons from the bites of mosquitoes*, by careful screening of doors and windows, and by killing all the mosquitoes that can be found in the house. The importance of doing this is evident, if it is remembered that malaria can only be transmitted from the patient to a well member of the family by a mosquito biting first the sick and later a well person.

An order was adopted in May, 1902, including malarial fever among the diseases that must be reported to the Board of Health by physicians, or by householders if no physician is called.

By order of the Board of Health,

James M. Codman, Jr., *Chairman*.

H. Lincoln Chase, M.D., *Agent*.

The President.— Mr. Underwood's name is down for the discussion of this paper.

Mr. Underwood.— Mr. Chairman, I am very sorry that Dr. Smith is not present to lead this discussion, because he is no doubt one of our best authorities on mosquitoes in New England. I think that every one who has been here to-day must certainly have been impressed with the splendid energy which we have seen displayed by the Brookline Board of Heath toward the better protection of the public health. We have seen their well-equipped bacteriological laboratory, their perfectly appointed contagious hospital, their public baths; and we have just heard the account of their very interesting and successful fight against the mosquito.

A great many of us may reside in towns where it would be hard to get the people interested in this subject of mosquito extermina-

tion or to raise the money necessary to carry on such work. In looking into the mosquito problem somewhat during the last year or two, I have found that a great many people are not really aware of the first principles of mosquito extermination. They do not know that mosquitoes come from the water. In spite of all the literature which has been written and published on the subject in the last few years, a great many persons out in the country do not know to-day where mosquitoes come from. An illustration of this fact came to my attention during a recent trip to Maine. I was interested in looking up mosquitoes in some of the pools in the woods. The Indians and the guides pooh-hooded the idea that the little wigglers, which we found there, would ever turn into mosquitoes. They could not be persuaded that they would do so. It was not until I put some of the larvæ into a glass of water and took them into the camp, and got some of the guides and Indians to watch them, that they became firmly convinced that these little wigglers were mosquitoes. After they had seen the little fellows transform from the larvæ into pupæ, and then from pupæ into the adult mosquitoes, they began to get interested. I have seen those men watching mosquitoes by the hour, with their hands on their chins, their elbows on the table, so interested had they become in the subject. We do not need to go to the country districts of Maine to find ignorance upon this subject. Many people in our near-by towns are uninformed.

A good many of us, as I have said before, may be inhabitants of towns where it would be hard to get the money together to fight mosquitoes; but we might get the people aroused to action in a very simple way. Let us interest the teachers and children of our public schools in the question. Nothing better could be done by some of the local boards of health than to furnish mosquito larvæ in June to the teachers of the public schools. Let them keep some in glass jars upon their desks, so that the children can watch them. If the child once sees the wigglers transform or if he once sees a mosquito emerge from the larval stage, coming forth as an adult insect, he will become interested at once. He will take the matter up at home, and tell his parents about it; and soon we can spread, at a very little expense, a knowledge that will be of some benefit.

I think that every board of health should make some provision to

get some larvæ in the spring, before schools close for the summer vacation, and give them to the teachers, and tell them in a simple way about their life history. It seems to me that much good work can be done in this way at a very little expense.

The President.— Is there anything else to be said upon this extremely interesting subject? Haven't you got something, Dr. Hill? I thought I saw a responsive look.

Dr. Hill.— I should like to suggest that it would be advisable, I think, for all boards of health to put the reporting of malaria on a compulsory basis. It would help us to know exactly what is happening in that line.

The President.— If there is nothing more to be said upon this subject, this concludes the list of papers for this evening. Is there any other business that can now properly come before the Association?

Dr. Kite.— Mr. President, I should like to suggest that there has been only one number on the programme that has not been thoroughly satisfactory; and that is the first discussion. It seems to me that Dr. Hill and Dr. Chapin and Dr. Denny have done an immense amount of work in regard to the report on diphtheria bacilli in well persons, and I move that their conclusions be read at the next meeting and that the discussion be continued at that time.

The motion was adopted.

The President.— It will appear on the programme at the January meeting.

Mr. Pilsbury.— I fear that the many who have gone would not forgive the few who remain if we did not pass a vote of thanks to the Brookline Board of Health for their courtesy and kindness.

Cries of "Second the motion."

Dr. Durgin.— I move a vote of thanks of the Association to the Brookline Board of Health for its warm welcome and its excellent entertainment of the Association to-day.

The motion was adopted, and the Association then adjourned.

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The Preparation and Free Distribution to Boards of Health of Antitoxine.

Location of Small-pox, Diphtheria, and Scarlet Fever Hospitals.

The Reporting of Cases of Chicken-pox.

Provision for the Care and Isolation in Hospitals of Patients Ill with Measles.

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March 31, 1902.

THE JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH.

THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH was organized in Boston in March, 1890, with the following objects: the advancement of sanitary science in the Commonwealth of Massachusetts; the promotion of better organization and co-operation in the local Boards of Health; the uniform enforcement of sanitary laws and regulations; etc.

THE OFFICIAL JOURNAL OF THE ASSOCIATION is a quarterly publication, containing the papers read at the meetings, together with verbatim reports of the discussions following them.

All communications to the Association should be addressed to the Secretary, **JAMES C. COFFEY, City Hall, Worcester, Mass.**

Subscriptions and all business communications should be sent directly to

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